

WAR WITH DISEASE

SECOND EDITION

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A. Leslie Stevenson.

WAR WITH DISEASE

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BY

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'The great thing in all military service is Health; and you will agree with me that it is easier for an officer to keep men healthy than for a physician to cure them.'

LORD NELSON, March 11, 1804.

SECOND EDITION



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TO

FIELD-MARSHAL: HIS ROYAL HIGHNESS

THE

DUKE OF CONNAUGHT, K.G., K.P.,

ETC., ETC.

Hon. Colonel South of Ireland Imperial Yeomanry.

PREFACE TO THE SECOND EDITION

A SECOND edition of "War with Disease" has been demanded much sooner than I dared to anticipate. For this demand I am indebted to two factors. First, a few regiments have ordered a large number of copies for distribution amongst the men of the regiment. One regiment even asked me to quote a special price to enable them, out of their funds, to distribute a copy of the book to every man on their muster-roll of nearly one thousand strong. For the second unexpected demand I feel I am indebted to the uniformly friendly and favourable notices of the press. A steady sale for the book still continues to members of the public, who are in no way connected with the army. The result is the present issue to supply these wants.

I have added to this edition a special lecture on "Health and Fitness," which I had the honour of delivering to the recruits of the cavalry regiments stationed in Ireland during the year. The hints contained in this lecture complete the knowledge which everyone should possess if he is to avoid sickness altogether during his life.

Since I first delivered the lectures contained in this little book, I have had the honour of repeating them to the officers of the Staff College in Camberley. For this

audience I went a little more deeply into the scientific reasons for the suggestions I made. In this edition I have amplified these parts, and, as far as memory would permit, have here reproduced the lectures exactly as I spoke them at the Staff College in October last.

As the teaching of hygiene, put in a popular way, has proved so successful, I have ventured to add, as a second part of this book, the introductory lectures which I gave to my ambulance section, in the hope that medical officers of both yeomanry and volunteer regiments might adopt the idea of making their ambulance classes of greater use to the regiment and to the public generally than mere renderers of first aid can ever hope to be. The publication of my second lecture to this section has a special object in view. I want to show other teachers how interesting and easy the subject of anatomy can be made if it is, as I venture to think, properly taught and made "alive." My South of Ireland Yeomanry class knew their anatomy at the close of the course as well as the average medical student. All took an interest in the subject. It is in the hope that the lecture may stimulate this interest and be a help to teachers that I now publish it. It will, of course, at once be seen that diagrams are required, and but for the necessity of publishing the book at a popular price, they would have been included.

December, 1906.

PREFACE TO THE FIRST EDITION

THE subject-matter of these lectures was first arranged in accordance with a plan of mine of making the Ambulance Section of the South of Ireland Imperial Yeomanry a Preventive Medicine Section as well. This idea suggested itself to me in South Africa by my seeing the state of ignorance in which our men were sent to the front. They did not know the most simple and most necessary of sanitary laws. But ignorant as the men were, I found them very quick to learn and anxious to do the right thing, if it was only explained to them in simple, plain English. This, then, suggested the idea of thoroughly educating a certain number of the men to act as "sanitary policemen," who would not only know what was right, but could tell their comrades *why* certain precautions were right and necessary.

My Yeomanry Lectures, however, consisted of a series of twelve, embracing Anatomy, Physiology, Hygiene, and First Aids, and it was at the request of General M. F. Rimington, C.B., that I arranged the course of four lectures now published on the subject of Preventive Medicine only. These lectures were delivered by me to the officers, N.C.O.'s, and selected men of the Cavalry Brigade at the Curragh during the months of March and April of this year.

They are now published exactly as they were delivered

to an audience which was kind enough to listen to them with very marked attention, and, I think I may say, appreciation. At any rate, General Rimington and his Brigade-Major, Brevet-Major Ansell, were kind enough to ask me to publish the lectures "for the general information of all ranks in the Army and *pro bono publico*." If, then, these lectures result in doing some good, the thanks are due to these officers for the trouble they have taken concerning them, and for the very valuable practical hints for which I am indebted to them in their preparation. I also have to thank those officers and men who enlivened the proceedings at the close of my lectures by asking questions on the subject-matter treated of, and thus enabled me to bring out still more clearly the points I wanted to drive home. Some of these questions and answers I hope to publish should another edition of "War with Disease" be called for by the Army, when I hope also to include the illustrations which I exhibited in the lecture-room.

I have in particular to thank General Rimington for his remarks both before and at the close of my lectures, and for the encouragement he gave me in the performance of a task which was to me the greatest possible pleasure.

11, MERRION SQUARE, N.,
DUBLIN,
May, 1906.

INTRODUCTION

WE in the Army are probably brought more into direct contact with epidemics of disease, such as that which occurred at Bloemfontein, than are the average civilians.

Consequently we are better able to realize their terrible effects.

Surgeon-Lieutenant MacCabe's lectures will prove to you that these diseases are not irresistible.

They can be fought and defeated in just the same way as any other enemy, by organization, initiative, and suitable strategy.

It is simply a question of correctly weighing the powers of our enemy and adopting the best plan for defeating him.

Surgeon-Lieutenant MacCabe will put this before you in a most convincing manner, in plain, straightforward language, which you can not only understand yourselves, but which will be easy for you to pass on to squadrons, troops, and sections respectively.

I am sure you, as sensible men, after hearing these lectures, will feel that you ought to have been taught the greater part of this at school, and will wish your children to be so taught.

I am certainly of this opinion, and prophesy that within the next ten years our board schools and colleges will have recognised their duties in the matter.

But social changes come in slowly, and the Army must in this, as I hope in all other points, become the leaders of what is not only a matter of common sense, but a reform of great importance, not only to the Army, but to the nation.

M. F. RIMINGTON,
Brigadier-General, Commanding
3rd Cavalry Brigade.

CURRAGH,
April 12, 1906.

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PART I
LECTURES ON PREVENTIVE
MEDICINE

LECTURE I

Introductory—Our plan of campaign—Physiology of the blood
—How to keep the blood in order—Drinking between
meals—Enteric and flies and dust—How to get men to
avoid drinking dirty water—Causes of enteric fever at home
—Anti-enteric inoculation—War's death-roll from sickness
—Object of the course of lectures.

GENTLEMEN,

In lecturing on the subject of the prevention of sickness in peace and in war to an audience composed of officers who have gained admission to the Staff College, I feel weighed down by a sense of responsibility greater than any I have ever previously experienced. I have been granted a glorious opportunity. I speak, if I may be allowed to use an anatomical expression, to the very higher centres of the brain of the army; I speak to the future leaders of the army of the Empire. If I should succeed in convincing you that sickness is preventable, if I should succeed in this short course of lectures in showing you how to prevent it, then I shall know that these words of mine will in future years be the means of warding off sickness and death from soldiers of the British Empire, and I shall rest satisfied that I have not studied my favourite subject in vain. But, gentlemen, I am weighed down with a sense of the gravest responsibility, for you are the Executive Sanitary Authority of the Army. Under your care is to be placed the health and lives of the soldiers of the King. If, then, when I have been given the

responsibility of addressing you, I should fail to interest you ; if you should decide that my subject appears unworthy of your study and attention, then I shall share with you the responsibility of many preventable deaths amongst young officers and men, then I shall share with you the responsibility for the invaliding out of the army men whose services to their country might otherwise have been of priceless value. Your medical officers advise you on sanitary matters, but on you must ever remain fixed the responsibility of deciding what steps you will, or can, take for the protection of the health of the troops under your command. If, then, you do not know of the recent advances which have been made in sanitary science, how can you face the responsibility of this decision ? You cannot in justice to your men remain in ignorance on such a subject, and on that ground I base my plea that you should listen to and impartially consider what I have to say to you.

In introducing the subject of Preventive Medicine to your notice, I ask you to grant to me—what I shall prove to you later on—that all sickness has a cause. Now, if you grant this, it naturally follows that if you remove that cause, or prevent its effects, you do away with sickness, and I may here remind you of the remark made by His Majesty respecting these diseases. “If preventable,” said the King, “why not prevented ?” The diseases which are still filling your military hospitals are chiefly caused by pathogenic—that is, disease-causing—germs, or microbes, or parasites, or amœbæ. I do not intend just now to trouble you with microscopic distinction. Germs have been proved to be the sole cause of enteric fever, of tuberculosis in all its forms, of malaria, of syphilis, and of gonorrhœa, which

still fill your military hospitals both at home and abroad. Germs are the cause of other scourges of the past in which white armies were concerned—namely, small-pox, cholera, typhus fever, plague, etc., and germs are the cause of still other diseases, which occur either in outbreaks or in isolated cases, namely, pneumonia, diphtheria, cerebro-spinal fever, scarlet fever, measles, and influenza.

Now I am greatly afraid that when I have gone thus far, and named so many diseases, you will begin to fear that I am about to give you all sorts of impossible directions for avoiding these diseases, the existence of which you would rather forget.

Gentlemen, you need have no such fear. Preventive measures, to be effectual, must be simple and guided by common-sense. What I do ask you is to declare war against these germs, regard them as enemies, powerful enough if they get the upper hand to prove fatal, not only to your own lives, but also to the lives of the men under your charge. If you decide to declare war against all pathogenic microbes, you will naturally desire to know more of the enemy you are called upon to fight, and you will immediately consider a plan of campaign. Let me help you in this undertaking, and the information you require about your enemy will come naturally as we proceed to unfold this plan of campaign. I do not think that there is anyone in this room, from the General himself even to the youngest amongst you, who would quarrel with my strategy when I say that, having declared war against an enemy who is vulnerable in his home and birth-place, the very best thing you can do is at once to attack and destroy him there and then. That would end the war once and for all, and that is what I want you to do in all cases where it is possible

with these death-dealing microbes. Let in the fresh air, and disinfect the nuisance and the damp, dark spots where germs find a home and multiply. But in many cases you cannot attack your enemy in his stronghold, for the simple reason that your scouting is at fault, and you cannot find the enemy's headquarters. Here again I appeal to every one of you as to the strategy. The next best thing you can do is to prevent the enemy from invading your territory—that is, your body. This principle, which was first applied by Lord Lister in the treatment of wounds (for suppuration and the formation of what we call matter, or pus, is also caused by micro-organisms, and by nothing else), is the principle which I want you to adopt where possible with regard to the organisms which cause disease. And *à propos* of this principle, and to show its importance, I may tell you that there are hundreds of officers and men alive and well to-day who have received wounds from which they would certainly have died had it not been for the application of the principle of Lord Lister, known as antiseptic, or, better, aseptic surgery. But this principle has not yet been advocated as a means of defence against the landing of an invasion of enteric or other organisms.

One of the principal and most practical parts of my lecture to-day will be devoted to showing you how Nature provides for this necessity if you will only give her half a chance. But before we go into that question I want to make clear to you what your third line of defence is, if (1) you cannot destroy the enemy in his native place, and (2) you cannot prevent his effecting a landing in your body. Gentlemen, the second line of defence has been broken through hundreds and hundreds of times with every one of us, and it is quite certain that not one

of us would have survived the first few weeks of our existence had it not been that Nature has equipped each of us with a well-fitted-out army within the blood to fight our battle, whether we are asleep or awake. To explain to you what I mean—for the keeping of this army fit and ready for war is our last line of defence, and the most important work of our lives—it is necessary that I should turn aside and tell you something of the physiology of the blood.

The blood consists of three parts : the plasma, which is a clear transparent fluid which carries the nourishment derived from the digestion of food to the different tissues ; the red corpuscles, which are so numerous that they make the whole fluid look red, and whose duty it is to carry to the tissues oxygen, which they take up from the air in the lungs, and to carry back to the lungs the carbonic acid gas which is given off as a result of the working of the muscles. These red corpuscles are quite separate from each other, and apparently have an existence and a life of their own. They exist in countless millions in each of our bodies, and are the workers of our individual world. The third element of the blood consists of the white or colourless corpuscles. They are nothing like as numerous as the red, but they are undoubtedly militant inhabitants of that little world, our body. Their duty is—and they perform their duty with the utmost keenness—to rush through the thin walls of the smaller bloodvessels and close on and instantly devour all pathogenic microbes which dare to invade the territory. Gentlemen, this is not romance, but sober fact, proved by many patient workers, by repeated experiment, and now placed beyond all question. These corpuscles have been seen, for instance, in the transparent tissues of the frog, to rush at and

literally—as I think an Irishman described himself as doing single-handed, surround the enemy. Well, the white corpuscle has been seen to extend itself—for it is a shapeless, flabby little mass—round a microbe and eat it up. There are millions of these white corpuscles in each of your bodies, and as soon as it is reported at your intelligence department, through your nervous system, that a force of hostile microbes has landed, and is at work with its poison, the blood is immediately directed with increased force to the seat of the invasion. The red blood corpuscles, the civilians of the blood, give way to the white ones, the soldiers, who crowd in countless numbers to the front. Meanwhile the invaders, finding heat and nourishment where they have landed, proceed to divide and redivide into new and perfect specimens of their kind. One single enteric microbe under such circumstances would, if let alone, multiply in twenty-four hours into several millions of perfect specimens, each one capable of redividing, under suitable circumstances, into as many millions more. The battle rages, and in a few minutes it is probably decided whether you are to be a victim of the fever, or whether, at the cost of a few million corpuscles—for the microbes give out a poison which kills your brave defenders, whose dead bodies are cast out with the waste products of your body—your health and your life are to be saved. Now the object of telling you all this is simply to get you to take such precautions as will result in having your white corpuscles and the plasma in which they live in a healthy condition, lest the white corpuscles lose their fighting-powers. I hope that I have excited your curiosity enough to make you anxious to know what these precautions are? Well, they are

all simple and common-sense, and may be summarized as follows :

1. Attend to the recruiting department of your blood by taking care that you have, at regular intervals, an ample, but not an excessive, supply of good nutritious food.
2. So arrange your ventilation that both night and day your air-supply is so free that you avoid taking into your lungs air that to any large extent has been expelled either from your own or anyone else's lungs.
3. Take care that nothing interferes with the free action of the skin, the bowels, or the kidneys.
4. Take plenty of good hard exercise in the open air regularly.
5. Avoid the practice of drinking anything, either alcoholic or non-alcoholic, between meals.

I am sure by the time you have heard my last condition you will have come to the conclusion that this is a system of training that I am urging you to adopt, and, gentlemen, so it is. If you are to avoid disease, and really to enjoy life, you must be, and keep, "fit." Professor Parke's definition of Hygiene is that it is "a science which aims at rendering growth more perfect, decay less rapid, life more vigorous, and death more remote." In other words, Preventive Medicine and Hygiene are only scientific training of the human body.

Now I am sure that if you are disposed to dispute any of the five great principles I have laid down, for keeping your white army in condition, you will first question me on the fifth condition. You will want to know why I object to your drinking with an empty stomach. Gentlemen, I object to your drinking under

such circumstances, and under such circumstances only, because at home and in peace time you generally drink something which has more or less alcohol in it ; and while a little alcohol is harmless, and may even be said to be good (because it acts as a stimulant to digestion) if taken with food, when taken between meals it only tends to upset digestion, and on being absorbed into the blood its action is to slow and render unsteady the movements of the white corpuscles. But if I object to it in peace, I object to it doubly in war or on foreign service, especially in any place where the water-supply is not above suspicion. Drinking between meals breaks the most important rule of training, and is *the* best way of securing the unopposed landing of an army of enteric or dysenteric germs. And this brings me at once into the question of the prevention of those diseases.

On active service more men have come by their deaths by the misuse of their water-bottles than by the bullets of the enemy. The enteric statistics—for enteric is a water-borne disease—bear me out in this statement. A man who wants to keep himself fit knows that he has got to fight the first sensations of thirst when on the march, or when doing his training for an athletic contest. He knows by experience that if he does this and refuses to drink his thirst will wear off, and he also knows that if he drinks he will suffer far more from thirst afterwards. Therefore, the man who wants to be fit, so that he may serve his country better, or win for his regiment's credit some athletic prize, refuses to drink until meal-time comes, when he drinks as much liquid as he feels to be necessary. Now, why do I attach so much importance to this in the way of preventing sickness ? Will not drink, especially impure water, do as much harm taken with meals as it will taken

on the march? I say No, it will not; and that is my very point. If you only drink when you are eating, the presence of the food in the stomach stimulates the flow of the acid gastric juice and of the other fluids, such as the bile, which pour into the intestines in the presence of food, and act as disinfectants there. Now, the germs which cause enteric very quickly lose their vitality in the presence of these. If you drink on the march your stomach is empty and in an alkaline state, and this state allows the germs to pass without a fight and with all their strength into your intestines, where they set up fever.

Now, I do not wish you to take it from this that any water is safe if taken with meals. I only say that it is much safer, that if you act up to the "in training" principle you minimize your risk ever so much; but no soldier who really cares for his own health on foreign service should drink any water that has not been boiled, if he can possibly help it, and to my mind the best way to insure that water has been boiled is to drink it in the form of tea or coffee.* Had our soldiers in South Africa been told this much before being sent on active service, and had they been told of the necessity of keeping the inner surface of the body clean by means of a daily evacuation of the bowels—an absolute necessity of health, but too apt to be treated carelessly by the young soldier during the early months of his life on active service—thousands of the graves which are now dotted over the lonely veldt would never have been dug, and thousands of men of the "great silent army

* Since these lectures were first delivered, Major McNaughton, R.A.M.C., has reported (*Journal of the R.A.M.C.* for October, 1906, p. 372) that even cold tea kills the *Bacillus typhosus* in water in a few hours.

of the dead " would now be alive and well. I make this statement deliberately, fully conscious of its importance; and I make the statement fully prepared for the objections with which some of you may meet it. Gentlemen, I have very little doubt but that some of you have heard that it is useless to take trouble over the purity of the water-supply while you have flies, which you cannot control, carrying enteric from your latrines to your mess-tents. Well, with regard to that, I propose, when we come to our lecture on Camp Hygiene, to show you how you can carry the war into the enemy's camp, and prevent the flies from finding an attraction in your latrines. No end of experiments have been made with a view of proving that flies do carry enteric, and I have no doubt that in cases in which an outbreak has already been started they might possibly carry an enteric microbe about with them. But most of the experiments have resulted in a verdict, so far as the fly was concerned, of "Not guilty" or "Not proven." And, gentlemen, if you reflect for a moment, you will see that this verdict is very likely right. Have you ever in your tents watched the common fly as he stands in the sun? If you have done so, as I often have, you will see that he is very busy attending to the sanitation of his legs and feet. You will see him cross and recross his little feet, and wash himself like a clean cat. Now although an enteric microbe, with the filth in which it is probably embedded, is very small to us, yet it is of such a size that no self-respecting house-fly would allow it to remain on his body. And again—still appearing as special pleader for the house-fly—if he did bring you an enteric germ or two, he could only bring them as single spies, whereas in the water-supply they are brought in big battalions.

A water-bottle filled from an infected source, and heated up by the soldier's body and the sun, would certainly bring countless millions. Now, it is one thing to ask your white army to fight a few microbes brought to you by flies if indeed they are brought in this way—and quite another to ask them to take them on in millions. However, I do not wish you to think that I pay no attention to the case that has been made against the house-fly, and in another lecture I intend to prove—to your satisfaction, I hope—that he is a carrier of the bacillus of tubercle; but what I do say is, that if you attend to the question of your water-supply properly, you will leave the house-fly without any enteric germs to carry. I have not the slightest doubt but that in such deplorable scenes as were witnessed round Bloemfontein, when our army was encamped there under Lord Roberts, the fly did, in fact, swallow enteric germs, and pass them on through his body to the food of the healthy; but it was round Cronje's laager, and in the crossing of the Modder, that your battle-worn and ill-fed troops, in ignorance of what they were doing, poured poison from their water-bottles into their empty stomachs, and so gave the flies a chance to pass on the disease, which had then become an epidemic.

Another objection will be urged, and that is that these germs are brought in dust. To that I reply that they may be; but if they are, they are brought to you weakened by the effects of a good air- and sun-bath, and both air and sunlight spell death to pathogenic microbes. This statement you may take as a general principle. No, gentlemen, these objections are generally urged by sanitarians who are not thorough enough to see that the water-supply is really looked after, or who are too lazy,

or not enough in earnest, to carry out a process which must be done thoroughly and constantly if the water is to be safe for drinking purposes ; especially if your soldiers do not know that water taken between meals is at least ten times as dangerous as that taken at the same time as food.

Now I am sure that some of you are ready to urge another objection. Some of you will say that "No doubt what you say is true"—I hope I have convinced you of that—"but you can't get soldiers to take these precautions, simple as they are, and hence enteric will and must go on." Gentlemen, I can only answer this objection in one way, and that is to tell you that I have heard the objection urged before, and have found a way of getting over it. This obliges me to tell you something of my own experience. I had the honour of serving in South Africa during the late war. I need not tell you that I went out there very full of the idea that if the army was losing heavily from disease, that disease ought to be prevented, and I was quite resolved to spare myself no trouble if by taking it I could probably prevent one single case of enteric. I was attached to mobile columns, and all went well until the rains came to wash the colonies of germs out of their hiding-places into the water from which the soldiers drank, which they did without taking any precautions, filling their water-bottles as they met the water, and drinking there and then. I, of course, at once spoke to my immediate superior officer, a Major of the R.A.M.C., about the cause of this deplorable waste, which was costing us at least ten men in sickness to one we lost by wounds. He first gave me the answer I am now fighting : "It is useless to try ; the men will drink when and where they can." This answer was confirmed in

substance by the combatant officers of the columns, and I had to set to work to learn how the most valuable men in the kingdom—the men who had joined our army to fight our battles—were to be prevented from doing what I regarded as nothing less than ignorantly committing suicide. The first idea that struck me was to design a valve so that the water-bottle could be emptied easily, and only filled at the water-cart. It simply contained an air-lock, and would not allow water to run in from a stream or pool. I forwarded the idea to the P.M.O., but apparently no notice was taken of it, and I say now very properly so; for the whole idea was wrong and unnecessary; and whilst I was waiting for it to be considered I found an easier way, but one which took time and trouble. Instead of trying to put difficulties in the way of drinking (which, of course, I should never have thought of only that I believed what I was told by men who had more experience of soldiering than I had), I, without any orders or consultation with my superior officer, who keenly resented anyone trying to do what he said was impossible, went round quietly and had a good square talk with as many men as I could get an opportunity of talking to. I told them what I have told you to-day of the habits of these germs, and of the means they had of killing them if they would only take tea or coffee; or if they had to drink water, to eat something with it, so as to cause the gastric and intestinal juices to flow. I generally finished my conversation by asking them if they had anyone at home whom they wished to see again, as if so, they would, by resisting the first sensations of thirst on the march, avoid the greatest, and, comparatively, almost the only danger of war. Gentlemen, I would not trouble you with all these

details, only that I found that these men, when it was fully explained, said that of course they would not drink on the march, and as a matter of fact not a single one of them afterwards passed through my hands sick with enteric. Is it not, then, gentlemen, worth your while to know enough to be able to tell your men why, for their own health's sake, they should not do this, or should do that? They will not, with regard to these matters, obey what appears to them an unreasonable order. Their thirst is immediate, the danger is more remote, and it requires the conviction that to drink is probably to sicken, perhaps to die, to make it worth while to conquer the thirst. Well, gentlemen, the avoidance of the other diseases which I have mentioned are also matters of common sense and knowledge. In my next lectures I shall attack them under the heads I have laid down—namely :

1. To destroy them in their habitation.
2. To prevent their effecting a landing in our bodies.
3. How to keep "fit" enough to fight them if they do effect a landing.

To-day, however, in order that we may part company with the pleasant feeling that something has been accomplished, something done, I must ask you to have patience with me while I finish, once for all, the subject of the prevention of enteric fever. In war, as I told you, the great means of the spread of this fever is the water. I shall in my last lecture give you some simple hints, which may be summarized in the sentence, "Don't foul your own nest," to prevent the spread of the fever in camp during its stage of incubation. To-day let me tell you how this illness spreads amidst the luxury and apparent security of peace. You have

all heard, I am sure, of bad drainage as a cause of enteric. Well, bad drainage has never directly caused a single case, but what emanations from bad drains do, is to depress the vitality of the tissues generally, and particularly the white corpuscles, upon which they act as a poison and slow their movements, so that the individual who lives in an ill-drained house is rendered an easy prey to the first pathogenic germ which finds a landing in his system. The bad effects of drainage are particularly felt by those who pass the night in an ill-ventilated room into which sewer gas finds its way during the lowered vitality of hours of sleep. Where, you will naturally ask, do the germs come from? Apart from the water-supply, which must be looked to in peace time as well as in war, the other proved carriers of infection are milk, oysters, uncooked vegetables, and butter. To take milk and butter first, the germ is always introduced into the milk from the water which has either been added to the milk or used to wash the cans. Care and cleanliness will, of course, prevent this, but if the supply is under suspicion the milk should always be heated to near the boiling-point* in any place where enteric is known to be epidemic. The germ has also been found in butter, derived, of course, from the same source as the milk, but I cannot find a case in which any satisfactory evidence was forthcoming that a patient had been infected from this source. Personally, I am quite prepared to back the gastric juice and the bile to destroy the germs in any butter that ever was eaten with a good meal by a healthy individual. Oysters, I am quite satisfied, when taken with an alcoholic drink and no

* 140° F. is fatal to the enteric bacillus if maintained for fifteen minutes; so that if this is done, boiling is unnecessary, and the character of the milk is not destroyed.

other food, have caused numerous cases of enteric fever. Of course, oysters from the deep clear sea of the west coast of Ireland are perfectly safe, if they have not been kept in sewage-contaminated water. The bacillus of enteric has frequently been found in oysters, but, of course, it got into them from sewage in the water. As to raw vegetables, such as salad or celery, these, when washed with dirty water or grown in a soil polluted with latrine manure, have been found covered with millions of germs. Watercress taken from polluted streams is of course also possibly deadly. Raw vegetables are best avoided altogether on foreign service, or during outbreaks of disease of any kind, and, by the way, the mention of foreign service reminds me that the mineral waters sold in bazaars in India, and made by some of the smaller makers at home, have been known to contain germs of many kinds. These, then, as well as any food that has been too much handled by natives subsequent to its cooking, together with uncooked food, such as fruit, are best avoided. I think now that I have mentioned all the channels by which enteric finds its way into the human body, and in doing so I sincerely trust that I have not tired out your patience. I must, however, touch on one aspect of preventive medicine before I leave enteric altogether—that is, the generally considered abstruse subject of vaccines and sera. In simple language, a vaccine is a culture of disease-causing micro-organisms so modified that it cannot give the disease, but can educate the serum and white corpuscles to protect, to a greater or lesser extent, the individual from an attack of that disease. A serum is simply the clear part of the blood of, say, a horse, which has been rendered immune by injections of the toxins, or poisons, derived from

bacteria which it is desired to protect the individual against. Now, you have all heard of antityphoid inoculations. Some of you may not have been favourably impressed by what you saw of them when tried on the way out to South Africa. Let me tell you, however, that the defects of the system, which from the first was on the right lines, have almost altogether been overcome; and while none of the precautions should be relaxed for preventing a landing of enteric germs in the soldier's body, yet as an extra precaution I strongly urge upon you, if you are ordered upon service to any country, such as India, where enteric is endemic, and where it seems to get about in ways which are difficult to account for, to advise all the younger soldiers under your command to submit to this preventive measure, subject to the advice of your medical officer. Some very remarkable observations have lately been published on the number of those who get enteric in India who have and have not been inoculated, and this comparison goes far to prove that inoculation is a strong line of defence. It is very remarkable, too, the effect which a word of advice from the officer to his men has; and, personally, I should be slow to take the responsibility of allowing any young soldier of, say, under twenty-five years of age, to go to India without first having strongly advised him to go in for this preventive measure, which time has proved to be always harmless and very often successful. Indeed, I may tell you that in serum therapeutics and the use of vaccines lies the medicine of the future. The days are fast going when anyone will think of sending for a doctor so that he may pour a sickening drug into his already sick body. The educated physician will in

future be asked for his advice as to how to keep well, and when we are sick what toxin, or bacterial poison, is successfully fighting us, so that the doctor may take measures to help our white army in its fight with the invader. Practically I have finished, but wish, before we part to-day, to impress upon you a great change that has, during the past few years, come over public opinion with regard to Hygiene. First of all, I should tell you that at the beginning of the reign of the late Queen the science was undreamt of ; then the mean duration of life to dwellers in cities was as low as twenty-six years. Excluding infant mortality, which is still high in towns, the duration of life may safely be said to have doubled. The advance of sanitary science is the cause ; but the point I want to impress upon you is this : Fifty years ago an epidemic was always said to be either caused by a " planetary influence " or " the hand of God," while up to ten years ago, and even later, it was the fashion to sneer at sanitarians and belittle their work. Worse than that, it was the custom to take risks, and, with the saying, " I am not afraid of catching things," do the very things which ought not to be done. Gentlemen, that idea is as much out of date as is the idea of officers exposing themselves while under fire " in order to encourage their men," and for no other useful purpose. Now the public know, and you know, that the best officer is the one who does his duty by the enemy while he takes care of his own life and health and of the lives and health of the men under his charge. The South African War taught us that it is foolish for an officer to take risks unnecessarily in order to show his men that he is brave, a fact which his men, who are also brave, know beforehand. The Russo-Japanese War has brought home to us that preventable disease can

be prevented in war-time as it can in time of peace, and as a result of that war the nation will expect something more from you in this direction in the future. Let me give you a few hard facts which will impress what is expected of you in future more than any words I can utter. The history of warfare shows roughly that four men die of disease to the one who dies of wounds. In some wars the proportion has been much greater. For instance, in the Spanish-American War the Americans lost fourteen by death from sickness to one by wounds. In the South African War we lost 13,008 from disease to 7,091 killed in action and died of wounds ; but, on the other hand, we sent home 8,221 wounded invalids to the appalling number of 63,644 cases of sickness, mostly enterics, of course. Indeed, in the first two years of the war we lost the services of an army corps from enteric, so that sickness cost us in actual loss of men more than four to one our loss from wounds. Now, in the Japanese War, the Japanese lost over 65,000 killed in action, and just over 15,000 died of sickness, mostly of an outbreak of beri-beri, out of an army of over 500,000 men. With the exception of the outbreak of beri-beri, which an alteration in their rations stopped, their deaths were not due to the diseases which are now known to be preventable. The latter they prevented, and this is what the British public will expect of you in future wars. You will ask how this was done with the Japanese, and my reply is that the medical officer, freed from the care of sickness, was, as sanitary officer, everywhere. To quote from the report of Major Seaman, " Notices were posted that such and such water required boiling, such and such food was not to be consumed ;" and, continues his report, " such is the respect and discipline of every soldier, from the G.O.C. to the file in the ranks,

that obedience to his order is absolute." But, gentlemen, there is no mystery in sanitation, and if you listen to what I have to tell you in this course, and ask me questions on any point you do not quite follow, and if in practice you follow the advice, you can prevent these diseases just as well as did the Japanese and as did the Russians ; for, as I shall show you later, their medical service and their camp sanitation left little to be desired. To prevent disease you have to realize that sanitation is only common-sense, and you have to spend some time seeing that the men under your charge grasp this fact too. Gentlemen, I thank you for your attention, and shall be very pleased to answer any questions any of you would like to put to me. Remember that I shall have failed altogether unless I teach you well enough to enable you to pass on the information and to teach others. My object in this course of lectures is to give you that knowledge which is necessary if you are to avoid for yourself and comrades all chance of coming under that saddest of announcements in the *Gazette*, "died of disease ;" so I sincerely trust that with such an object in view, all officers, who may have any doubt upon the subjects treated of to-day or to be treated of in my following lectures, will at once question me on the point, so that I may make it clear.

LECTURE II

Tubercular diseases—The bacillus of tubercle—How it may be fought—The effects of an open-air life—Pneumonia—Influenza—Small-pox—Venereal diseases—The prevention of these diseases—The loss caused by them to the army—The gonococcus attacking the eyes.

IN resuming our study of Preventive Medicine, let me remind you of the lines upon which, in my last lecture, I laid down that our fight should be carried on. In that lecture I told you that my proposal was to ask you to fight disease germs under the three heads :

1. To destroy them in their habitation.
2. To prevent them effecting a landing in our bodies.
3. To keep fit enough to fight them if they do effect a landing.

Under these heads I dealt fully and finally, I hope, with the subject of enteric fever. To-day, in attacking the diseases to which we are subject in this climate, let me commence with Tuberculosis, which, under the name of pulmonary phthisis or "consumption," or in the form of tubercular meningitis, or inflammation of the brain, or as tubercular disease of the bones, joints, or glands, is responsible for more deaths in these islands than are caused by any other three diseases. Indeed, so great is the number of deaths caused annually by the tubercle bacillus amongst all civilized and semicivilized people, that it has been

estimated that, were the ravages of this disease to be stopped for a single generation, the world would be overcrowded, and there would no longer be room for the human inhabitants of the globe to live upon its surface. We are not concerned with what must happen then, but we are concerned, and we are deeply concerned, with the effects which this preventable disease is producing on our army at home and abroad. The records of the recruiting Medical Officer will show you how many otherwise desirable officers and men are never allowed to join the army at all, simply because they are already victims to the disease in its early stages. Your hospital reports, your death-rate, and, above all, your invaliding returns, will show you to what a wastage your army is still subject from this cause. Yet, gentlemen, I repeat that tuberculosis in all its forms is a preventable disease, not, perhaps, preventable amongst the poor, who have not the means at their disposal to prevent it, but easily preventable in the army, where, according to my views, it ought to be unheard of, instead of being, as it is, a source of a greater loss than we can afford amongst our younger officers and our men.

Let us, then, declare war against tuberculosis, and let us commence, as I suggested in my last lecture, by learning something of our foe.

In the old days consumption, or scrofula, as it was often called, was supposed to be an hereditary disease, and undoubtedly an inability to fight the bacillus from an hereditary weakness of constitution did, and does, exist. But, no matter what the weakness of the constitution, unless you allow an invasion of a greater number of tubercle bacilli than the invaded individual can kill by means of his white corpuscles, there will be no case of tuberculosis started. That is a definite state-

ment upon which I am prepared to stand, and if you accept it you will naturally be anxious to know something more of the germ which causes the disease. Where does it live? How does it get into the body? What is it like? These are questions which I propose to answer for you now, and I hope that you will have enough curiosity about the matter to desire to know who discovered the bacillus, and so paved the way for our victorious war against its invasion. It was Professor Koch, the great German bacteriologist, who, in 1882, discovered, after a most painstaking search, what was the true cause of all tubercular diseases. The bacillus is like the rest of its tribe—an almost inconceivably small vegetable cell which multiplies itself rapidly by division, and gives off a poison which breaks down the tissues upon which it lives. It attacks most animals as well as man, and it is a common disease in cattle. Cows which are kept much in sheds, especially in towns, sooner or later become victims to it; and domestic fowls which are kept in close hen-houses are prone to outbreaks of the disease if it gets started amongst them, which it does if a tubercular patient spits in any place where these creatures can get a chance of swallowing the sputum. Indeed, tubercular sputum is the great source of the spreading of the disease, and it is from the sputum which a tubercular patient coughs up that the best cultures of the bacteria are obtained. This, then, indicates the direction in which we must direct our energies if we are to destroy the enemy in his haunts. Practically all cases of chronic cough, with expectoration, in young subjects are bacterial in origin. Therefore, our energies must be directed to preventing the disgusting habit of spitting about the floors of barrack-rooms, canteens, etc. Our efforts in this direction must be two-fold.

In the first place we should provide spittoons, containing a 5 per cent. solution of carbolic acid. This is at once fatal to the germ, and we must teach the soldier that, subject to a cough or not, he will not be allowed to spit except into these receptacles; and in the next place, that if a man has a cough, he ought to use a cheap style of handkerchief for the purpose of spitting into when he is moving about, such a handkerchief as can be burned subsequently. I am quite certain that our laundries are a great source of spreading phthisis, and it is very remarkable how many hands employed in washing sooner or later fall victims to the disease. The notice which I show you here should be posted in all barrack-rooms until the habit has been conquered:

“WAR OFFICE LETTER TO P.M.O.’s.*

“PREVENTION OF CONSUMPTION.

“In the interest of General Health, N.C.O.’s and Men are requested to abstain from spitting on the floors, passages, or any part of this building.”

Next, however, we have to assume that we cannot prevent tubercular patients from spitting, and so spreading their spores about to be caught up by our healthy soldiers. Tuberculosis, you must remember, is what we call an endemic disease in these islands—*i.e.*, it is a disease which is always with us. We cannot, then, destroy it, at present, in its haunts, or not in all of them. What can we do to prevent its effecting a landing in our bodies? In this we must make use of our allies, the

* War Office Letter to P.M.O.S.C.R., No. 30/961. 4800/6/1451. (A.M.D. 2).

sun and the air. The tubercle bacillus resists acids, unless concentrated ; it resists heat, unless prolonged ; it even resists the putrefaction of the grave, but it cannot resist the action of direct sunlight. That kills it almost immediately, if it is exposed to its rays. Therefore we pull up our blinds and we let in the sun in every way we possibly can to the rooms we inhabit and the camping-grounds we occupy. Bacilli float about in the air, if it is kept close and overcharged with carbonic acid from the lungs of men or animals, but they quickly, although not at once, lose vitality and get swept away by the fresh air if we admit it into our overcrowded rooms. And here let me give you a practical hint for preventing them making a lodgment. You cannot prevent this bacillus from getting into your lungs if you go into, as you often must, overcrowded and ill-ventilated theatres, lecture-halls, churches, or such-like buildings. How, then, are you to continue your fight ? You simply, as soon as you get into the pure air again, empty your chest as completely as you possibly can of all air, and when you have it thus empty give a couple of coughs to empty it still more. By this means you will disturb the germ-laden air which probably is already irritating the tender surface of your smaller bronchial tubes, and replace it with fresh air, which will, at any rate, give the best fillip to your blood to get ready to fight the germs should any pass into the lung tissue and there commence to divide up. Every one of you has successfully fought this fight many and many a time, and if you keep fit and trained, even going to a crowded and ill-ventilated church, or attending this course of lectures, is no real danger to you. But, mind you, don't forget to empty your lungs as soon as you get outside. Gymnastics, by increasing

the surface of the lungs, and therefore oxygenating the blood better, are a great preventative of consumption, and it is extraordinary the number of "pigeon-breasted" and ill-developed chests we see in the consumption wards of all our hospitals. These gymnastics ought, if you will only back them up with the means I have told you of, to keep pulmonary phthisis out of your regiments.

The other means of infection by which the bacillus finds a way into our bodies is through the digestive system, either in the shape of milk, when derived from a tuberculous cow—a very common way for children to get the disease in towns, but very rare and almost unheard of in the country, where cows are never kept constantly indoors—or in other articles of food, into which it is, in my opinion, mostly introduced by flies. You remember the stand I made against regarding the fly as a cause of the spread of enteric. Experiments, I told you, had mostly failed to prove the fly guilty, and in any case, even if he were guilty, I am comparatively fearless of the enteric microbe, provided you can give him a good dose of gastric juice on his arrival in your stomach. That kills him. But, unfortunately, this is not so with the tubercle bacillus. This acid has no effect on the germ, and as it has frequently been found in the bodies of flies, one of their most favoured dishes apparently being warm phthisical sputum, it behoves you to take all possible steps to keep flies off your food. Their exact mode of conveying the bacillus to you is this: A fly lights upon the freshly deposited sputum, and drinking it up, the bacilli thus introduced into his body begin to multiply there, and give the poor little fly diarrhœa. He now desires some more solid food, and lights upon your biscuits, or cake, left exposed on

the table. On these he proceeds to relieve himself of the now fast-multiplying tubercle bacilli, which you proceed to eat. I tell you this now so that you may be the more willing to take the trouble I propose to ask you to take in my lecture on Camp Hygiene, to prevent the fly from breeding by destroying by fire the dirt which you but too frequently leave round your camp; and although I tell you this—and you will, I think, agree with me that eating excrementitious matter containing pathogenic germs is not a nice idea—yet, if you keep fit, you need not be afraid that you will get phthisis even in this way. In fact, I am quite sure that no one can get consumption if he lives day and night in an uncontaminated atmosphere, and hence breathes nothing but pure air. If you give your blood pure air, it will kill all the tubercular germs you are at all likely to allow to find an entrance into your bodies. Even if phthisis has gone a considerable distance—and the examination of lungs in the dissecting-room has convinced me that many people who live to be old have had in their young days to fight, and fight hard, against this invasion—it can be arrested by a thorough and rational system of open-air treatment. Climate is supposed to have a great deal to say to the cure and prevention of tubercular diseases, but it is really the way we live, the constant open air, that acts as the cure. You have all heard that South Africa is celebrated as a place for patients suffering from this disease to go to for cure. The late Mr. Cecil Rhodes was undoubtedly rather far gone in pulmonary phthisis when he went to South Africa. His career there is known to you all, and there is no doubt that it was the sleeping out in the air of the high veldt which enabled him to fight down the germs which in

England were gaining ground in his lung tissues every day and every night. But it will interest you to learn that in this same high veldt, where phthisis is unknown amongst the whites, who live in the open, and have plenty of blankets to keep them warm at night, tuberculosis in all its forms is a perfect curse to the Kaffirs in their native kraals. The Kaffir children have it in all its forms—tubercular joints, lungs, glands, etc. Why is this great difference? I am perfectly sure that it is the want of ventilation at night in the overcrowded kraals. The Kaffirs have few, if any, clothes, and not many blankets, and they lie close together in their dark kraals, from which every possible stream of air is excluded, owing to the cold of the nights, and the sun, as you know, cannot get into these wretched low-doored and windowless dwellings. This, then, should give us the hint that sunlight and air are our great allies in fighting the disease, and are even more important than the attack on the enemy in his stronghold, because in this he has established himself in so many quarters that we cannot hope to destroy him altogether. If you had the right to command the public and forbid them to contaminate the free air with their possibly bacilli-laden sputa, as you have the right to command your own soldiers, there would be a hope—nay, a certainty—that tubercular diseases would be stamped out; but with the present state of public ignorance and carelessness you must only do the best you can, and be prepared to meet the invader when he lands in your system. It is a curious thing, by the way, how little the public mind being killed off, provided it is done slowly and by lingering disease. Were some disease to come amongst us which would kill by sudden death one man for the five hundred men annually killed by tubercular diseases,

I venture to say that we should hear a howl of execration from all sides against the Government, the Medical Profession, and even the harmless, necessary policeman who regulates the traffic. Tuberculosis kills very slowly, and hence we all agree to tolerate its existence amongst us.

From this all too common disease we pass on to the consideration of that which is fortunately ever so much rarer, but nevertheless interesting to us, as it annually costs us a certain number of soldiers' lives. I refer to Pneumonia, and I do not intend to take up your time at any length with a description of this disease. Its importance for us is that the way in which it is acquired provides the very strongest argument in favour of keeping the fighting force of our army ready for war. In medical works pneumonia is described as being of three forms. You need not worry about these distinctions, as all the forms are caused by micro-organisms. Up to quite recently we were all taught that exposure to "cold and wet," or "excess of alcohol," were the causes of Pneumonia. But patient workers, not satisfied with this explanation, were busy with their microscope and with their culture-tubes, with the result that the "pneumococcus," as it is called, was found in the affected lungs. Injection of cultures into animals proved that this germ was the cause of pneumonia. But presently it was discovered that the pneumococcus was present in the nasal cavities and in the saliva of the mouth of a very considerable number of perfectly healthy men. There is no doubt that, were I to take cultures from the mucus of the noses of a number of you here, or from the saliva of those of you who are foolish enough to breathe through the mouth instead of the nose, I should certainly be able to get a culture from

which I could give pneumonia (or septicæmia, a general disease caused by the same organism) to the all too susceptible mouse or guinea-pig. However, you need not be alarmed at this. It does not follow that any of you are about to get pneumonia. The importance, however, of the fact is this: the pneumococcus is everywhere, and you cannot prevent its getting into your nasal cavities now and again. But it is quite unable to get further, because your white blood corpuscles attack it and eat it up as soon as it attempts to effect a landing in your lungs, provided you keep these corpuscles fit and well. Or, in other words, you will not get pneumonia unless, at the time when you are harbouring these germs in your nasal cavities, you either (1) allow yourself to get so cold for a long period that your white army for the time being loses part of its vitality; or (2) you are foolish enough to get what is commonly called "speechlessly drunk," so that the movements of the white corpuscles are, like a drunken man's movements, aimless. We can almost imagine we see an ill-directed and drunken corpuscle grasping blindly at the place where it thinks it perceives the pneumococcus, while the real substantial death-dealing germ is quickly dividing up and throwing out his poison near by. Or (3), and last, you will not get pneumonia unless you are so unfortunate as, first of all, to get enteric or influenza, both of which diseases take much of the fighting vitality out of the soldier element of our bodies. From this, then, you will see that a properly cared for soldier ought not to get pneumonia, and with this word we pass on to a consideration of that disease which gives the only excuse to anyone who ever gets it. I refer, of course, to a previous attack of Influenza.

The preventive measures at present known to us with regard to this disease are, I must admit, in a very un-

satisfactory position. We know that the disease is caused by a specific micro-organism, and by nothing else, and we know that in cases of influenza that organism swarms in the secretions from all parts of the respiratory tract. It does not grow, although it continues to live, outside the animal body, except, of course, in specially treated cultures. With regard to the lower animals, the evidence of their immunity or susceptibility is contradictory. The German scientists have failed to give them the infection, although they have repeatedly tried; and we must remember that the Germans, owing to Government encouragement, and the French, owing to the same reasons, are far and away ahead of us in scientific medicine. But, on the other hand, the Local Government Board reports in this country give many cases from different parts of the country which seem to prove that horses, dogs, cats, and even hens, are susceptible, and have been seen to be sick with the disease, even before the epidemics in man have broken out. Practically, however, the point for us to learn is this: that the sputum of infected patients swarms with the organism, the secretions from the nose the same. Therefore, the possibility of influenza is another reason why soldiers should not be allowed to spit about their barrack-rooms, except into the properly prepared receptacles; and the danger of passing round the infection by means of the common washing of handkerchiefs is one that should not be lost sight of. All handkerchiefs should, in my opinion, be first treated with a solution of carbolic acid (5 per cent.) for twenty-four hours before being put into the common wash-tub. It is, however, but too probable that germs are expired in the air from the bronchial tubes of patients suffering from influenza, and it is certain that they are expired into the hand in the act of sneezing. These facts, of course, account for the

manner in which the disease runs through all the frequenters of an office or a mess-room. An attack, therefore, can only be guarded against, as far as we know at present, by avoiding crowded and ill-ventilated rooms, and keeping the white corpuscles as fit as possible, for these fight hard for us against influenza too, and they have been seen containing an influenza microbe in their centre, surrounded in the manner of which I told you in my lecture on enteric fever.

I do not intend to take up your time or attention by dwelling on that large class of diseases known as zymotic, scarlet fever, measles, mumps, etc., nor with diphtheria. These diseases you may take it will be caught by any susceptible individual who is exposed to infection from them. The only effective preventive measure against them is the immediate isolation of the individual, or individuals, attacked, and this measure must be equally quickly followed by the thorough disinfection of every article they have worn, or handled, or even been near. If you encourage your men at once to report sick, should they not feel up to the mark or experience any unusual sensations, you will have done your duty in this direction, and you may leave the rest with every confidence in the hands of your Medical Department. These diseases are generally introduced by young recruits, or by men returning from furlough; and it is important that, on the very first day of their joining the army, men should be taught how and when to report sick, so that no sick man may remain a source of possible infection to his comrades for an hour longer than is necessary. Nor do I intend to occupy any time with small-pox further than in passing to do honour to the name of Jenner, who discovered an absolute preventive of this most loathsome

disease. Before Jenner's day small-pox was a scourge of armies, and killed countless thousands in campaigns in the old days. Even as late as the Franco-German War the French lost by death from one division of their army no less than 26,000 men from an outbreak of small-pox which some Breton recruits introduced to them. The Germans who were pursuing this army, occupying their infected camping-grounds, and making prisoners of their sick, escaped altogether. But they were vaccinated and revaccinated on joining the army. The French had neglected to do this, and hence their loss ; but they learned their lesson in this war, and I am glad to say that, with the exception of the fact that their barrack-room accommodation is insufficient, and hence tubercular diseases are common, there is no army in the world better looked after, from a Preventive Medicine point of view, than is the French Army at present ; and with regard to one class of diseases of which I shall speak to you next, the French are in front of all other armies, as they teach their conscripts how to avoid these diseases, and they punish them if they fail to profit by the instruction.

But I am wandering from small-pox, which I had promised not to delay you upon, and in passing from it I shall only state that those who oppose vaccination cannot have read their history. Before Jenner made his great discovery no one would ever think of saying that any child was likely to grow up good-looking without expressing the hope, not that he or she would escape small-pox, as that was looked upon as inevitable, but that he or she would get the small-pox lightly enough for the skin of the face to escape the pitted and roughened appearance which was then to be seen in nearly every fourth face. It may interest you to know

that there has been, during the past summer, a very terrible outbreak of small-pox in the native quarters of Calcutta, which has killed, and is still killing, off natives by hundreds and thousands. All sensible white people out there, of course, got revaccinated, but there were four declared antivaccinators who "knew better." Well, they all got small-pox, and it may interest you to know that two of them got the disease so badly that they died of it. Revaccination prevents this disease, and therefore it very properly may be said to have ceased to trouble any civilized army.

Now, gentlemen, I come to deal with what is possibly the most important class of diseases I have yet had to speak to you about. I refer to Venereal Diseases. Your Medical Department keep statistics so faithfully with reference to these diseases that I fear the public, who have no means of knowing of the enormous prevalence of these same diseases amongst the civil population, have jumped to the conclusion that men who join the army immediately become what they call "immoral characters." Human nature and animal nature is, and ever will be, the same whether it wears a uniform, the frock-coat of high civilization, or the rough jacket of the working man; and while I desire to impress upon you the fact that these diseases are causing the country enormous loss annually by rendering so many of your soldiers unfit for service, and that the loss is, in my opinion, quite unnecessary, I do not wish to be understood to say that matters in this respect are in any way worse than they are amongst men of a similar age and class in civil life.

Venereal diseases, of which there are three varieties—*i.e.*, syphilis, gonorrhœa, and soft sore, are caused by specific micro-organisms, and are only acquired by direct contagion. The first of these diseases is really a

specific fever which runs a definite course, and which is followed by manifestations called secondaries and tertiaries, which are always serious to the patient, and the tertiaries in one form or another too often end in death. Gonorrhœa, which is characterized by a purulent discharge from the urethra, is not so serious a disease in the way of its remote effects, but, if neglected or acquired too often, it causes in later life a condition of the urethra known as stricture, which renders life a burden to the patient until his condition has been relieved by surgical treatment. The affection known as soft sore is only a local infection, and of no future consequence. I do not intend to dwell upon the greatness of the loss caused by these diseases to our army at home or abroad, nor do I intend at this stage of my lecture to harrow your feelings by telling you of the really dreadful effects—particularly the remote effects—which these diseases have on the human species. Instead, I propose at once to pursue our inquiry, “How can we hunt down the germs of these diseases in their haunts?” The Contagious Diseases Acts aimed at this very result, and while they were in force, in stations where their provisions were anything like properly carried out, they reduced the admissions from venereal diseases by about 50 per cent. Their operation, however, disclosed a dreadful state of life amongst the women of garrison towns, and as “Mrs. Grundys,” male and female, preferred the ostrich policy of hiding their heads from these things, the Acts were repealed. The horrors go on, but we don’t hear so much about them, and we insist upon any victim of the disease, whose appearance becomes too disgusting for us to look upon, retiring into some home of refuge, or into the grave. We cannot, then, in the present state of the law,

attempt in this case to destroy the germs in the sources from which our soldiers get the infection. How can we attempt to prevent the germs from effecting a landing in their bodies? No question has ever caused more discussion than this from its ethical and moral point of view. With these I have nothing to do here. My one consideration is how to prevent sickness. Continence is, of course, an absolute preventive of venereal disease, and upon that subject I should like to say, as a medical man, that continence amongst young men is to be recommended from a health point of view. I say this because I know that when young soldiers get together amongst themselves there are always some to tell younger men that indulgence in this vice is necessary for their health. That is wrong, and shows ignorance of physiology. All immature animals—and man is immature until he is passed twenty-five years of age, and in some cases later—are better, and their future offspring are better, if they renew the sexual orgasm voluntarily as seldom as they possibly can. In support of this statement, I quote the opinion of the late Sir James Paget, for years the leading surgeon in London, who said, when advising young men on this subject, that “marriage can safely be waited for.” As a help to achieving this end officers should do all in their power to insure that the minds of their men are pleasantly occupied in their hours of recreation. Idleness and temptation are the great predisposing causes of intemperance and vice. No effort should, therefore, be spared to interest the men in their inter-regimental games and sports, and nothing should be left undone to foster that *esprit de corps* which puts the honour of the regiment above all considerations, and regards it as a crime to put one’s self in the way of a preventable illness which results in the temporary or permanent loss of the

service of the individual to the regiment. A man's self-respect should be appealed to in this matter, for it is a great privilege, not lightly to be thrown away, to be in perfect health, and to wear the uniform of a regiment such as yours, whose history consists of a record of great deeds and of great sacrifices made by its members for the honour of the regiment and the safety of the nation. To the fostering of this spirit I attribute the great differences in the proportion of "constantly sick" between well-ordered regiments and those whose officers leave their men to their own devices while off parade.

But, gentlemen, great as these influences are, I know too much of human nature to suppose that they will stop a considerable portion of your men from putting themselves in the way of getting venereal diseases when temptation or opportunity present themselves. For these, then, I want you to do the next best thing, and that is to save them from the consequences of their acts by seeing that they are provided with a suitable ablution room, and are instructed in the use of it. The prevention of venereal diseases is carried out on the same principles as I have already told you for other diseases. You cannot destroy the germs in their haunts, which are none other than the bodies of the prostitutes who infest all garrison towns, who, indeed, infest all cities. You, then, try your very hardest to keep your men away from these sources of infection, so that they may not allow the disease germs to effect a landing in their bodies. If you fail in this, you instruct the men *immediately* to try to dislodge the hostile force by a thorough washing of the parts likely to be affected with plenty of soap and water. You leave in this ablution room a bottle of crystals of permanganate of potash. The men should be instructed to drop a few crystals of this into the water, enough to make it a good

rich colour. This, if thoroughly applied, and *if the interval after connection is not too long*, will oxidize any germs that are likely to be about. This is a simple precaution which has been extensively tried in civil life and, unofficially, of course, by some regiments, and the result has been that venereal diseases have been stamped out, except in the cases of those men who first get drunk and then indulge themselves in this way, while they are too much under the influence of drink to think about their future health.

Since I lectured on this subject first, Drs. Roux and Professor Metchnikoff, of the Pasteur Institute, have announced to the French Academy of Medicine the results of their experiments with the microbe of syphilis upon monkeys and men. They reported that, so far, they had failed to produce a serum the inoculation of which might be relied upon to prevent an attack of the organism of syphilis, but, on the other hand, they reported the results of experiments made in the Pasteur Institute, which go to show that they had discovered a simple and thoroughly trustworthy prophylactic measure, consisting of the application of an ointment composed of 10 parts of calomel to 20 parts of lanoline. Experiments, frequently repeated, upon monkeys, and afterwards upon a young medical student, who, in the interests of humanity, allowed himself to be inoculated with syphilis, have proved that this ointment, if well rubbed in within twenty hours of time of probable infection, may be depended upon to insure immunity, which, says Professor Metchnikoff, "is complete." This is a very valuable discovery, as this ointment can be made up by any chemist for a few pence, and it gets over the only objection to the permanganate of potash treatment, inasmuch as the latter is only of avail if it is applied practically immediately after connection.

About this treatment by permanganate of potash several questions were asked—mostly in that interesting talk which takes place after a lecture when people are really keen on knowing all their lecturer can teach them—the principal being: Is it necessary to use a syringe to prevent the infection of gonorrhœa? In my opinion, the use of a syringe is not necessary if the permanganate of potash is applied thoroughly before any secretions have had time to pass up the urethra. I also had to impress upon several questioners after my last lectures the fact that the ointment treatment only prevents syphilis, and the only way to avoid the danger of gonorrhœa is an immediate and thorough wash.

Now, gentlemen, when I tell you that at home and abroad your hospital admission rate from venereal diseases varies between 517 per 1,000, which it was in India but a few years ago, and a little over 200 per 1,000, which it is at present, it is clear that it is steadily falling, owing, I am glad to say, to the partial adoption of such means as I urge. You will see that when you are told that these simple measures will stamp out the disease, except in the case of those who have so little respect for themselves or your uniform that they get so drunk that they cannot take care of themselves, you will, I am sure, agree with me that the plan is worth trying in your regiment. It only means that when you have already used your influence to improve the tone of the men about these matters, you instruct a sergeant to see that the ablution room is ready, and is furnished with plenty of good soap, a bottle of permanganate of potash and a tin of the ointment, which any chemist can make up for you. You would try it, I am sure, if you just reflect upon the future of the man whom your medical officer has “invalided out” as a result of syphilis. I have seen them subsequently in our civil

hospitals—palate gone, nose fallen in—but I have promised not to harrow you with this side of the picture. Let us rather look at the gallant soldier as we see him on parade, or as we saw him in South Africa, happy and jolly under all circumstances, no matter how uncomfortable, and let us resolve that if there are means by which we can prevent him from going either now or later in life through any unnecessary suffering, we shall not leave those means untried by us and unknown to him. While on the subject of syphilis it is right that I should tell you as a further preventive against its worst consequences that soldiers still sometimes make a fatal mistake for their own future health when they come under treatment for this disease by refusing to submit to the hypodermic method of administration of mercury. In the Middle Ages, when syphilis was reintroduced into Europe in a severe form from the American continent, it was found that while its victims were literally breaking up in the most distressing way, workers in the mercury mines never had any really bad or fatal symptoms. This led to the treatment by mercury, and while it is given by inunction—that is, rubbing in through the skin—it was very satisfactory. Later on it was given by the mouth, and although this is far better than no treatment, mercury quickly upsets digestion, and has other bad effects if given for a long period by the mouth. The German Army doctors introduced the method of injecting the mercury into the substance of the muscles, and this treatment gives splendid results. Now many of your soldiers, in their ignorance, of course, of their future welfare, refuse this treatment of needle-pricking, and are given instead the mercury by the mouth. Carefully applied, of course, the method of rubbing in is productive of the best results, but soldiers cannot be got to do this properly. Worse than this, some of

them while feeling still in health throw their medicine on the floor, little knowing, of course, what the future of a neglected case of syphilis must be. Personally, I do not believe in many drugs—perhaps I know too much about their action—but no one who knows can doubt the good done by mercury, properly used, in cases of syphilis.

Before I pass from these diseases I should like to express the hope that none of you here are disposed to join in the attack which has been made upon me since the substance of these lectures was published. I have been accused, by some people whom I should have expected to have known better, of telling people how to sin without suffering sin's consequent sorrow. The question of sin or no sin is one for a man's own conscience, and while I would point out in reply to these critics that I have not been asked to speak on sin, I have been asked to speak on the prevention of sickness, and, moreover, even they can hardly have failed to note that sorrow and sickness follow on the neglect of sanitation, and not on the so-called sin itself.

I think this finishes what I have to say on these diseases, except one thing, which it would not do for me to forget, and that is, that it cannot be too widely known that the gonococcus which causes gonorrhœa can, by direct contact, be transferred to the mucous membrane of the eye, where, if neglected, it may result in total blindness. The importance of this is evident, as men have been actually blinded by using towels and handkerchiefs which have been previously used by victims of this disease.

Gentlemen, I propose to stop here to-day, and in my next lecture I hope to treat of the diseases of Foreign Service.

LECTURE III

Life in the tropics—The action of whisky on the liver—The protozoon of malaria—Mosquitoes—Malaria at Ismailia—The fight with mosquitoes—The tiger mosquito and yellow fever—Malta fever—Fleas and plague—Dysentery.

TO-DAY, gentlemen, we pass on to the consideration of the preventive measures which can be adopted on foreign service generally, and particularly those measures which can be adopted to prevent those illnesses known as tropical diseases.

Let me first of all give you some general directions which those of you who have already seen foreign service may consider quite unnecessary; but still, it cannot do you any harm to hear the reasons for the precautions which you have already found it necessary to take; nor must I forget that while I have no doubt but that many of you know far more of life in foreign lands than I do, still, I am speaking to young officers also who have not yet had any such experience, and it is my duty, if I can, to prevent these from having to learn from their mistakes as, perhaps, some of you have had to learn.

The first great difference to strike a resident of a temperate climate on entering a tropical or semi-tropical country was, I found, that while at home what is spoken of as a "chill" practically always attacked some part of the respiratory system, from the mucous membrane of the nose to that lining the smaller tubes in

the lungs, once we entered the tropics this type of chill entirely ceased ; but, if from any cause we caught a chill some part of the digestive system was affected instead. This resulted in either pains in the intestines, more or less severe diarrhoea, or even jaundice, with or without loss of appetite and general debility. Many attempts have been made to explain why this should be, but a discussion as to the cause of these chills would, although possibly of interest, be foreign to the scope of these lectures. What I must do is to tell you how to prevent them, and experience has taught us that the best way to prevent these abdominal chills is to keep the temperature of the abdominal cavity as even as possible by wearing, both day and night, a good cholera belt. That is the first general direction I would give those about to go on foreign service : Put on a good flannel cholera belt, and, except while in your bath, keep one on day and night until you return home again. And, as I have mentioned baths, let me say that experience has taught old campaigners in warm climates that the cold tub, which we all regard as such a necessity as well as a luxury every morning at home, is dangerous in those climates, and ought to be abandoned in favour of a tub from which at least the chill has been taken off, or even of a hot tub instead. Indeed, with regard to the hot tub, those of you who have followed closely the doings of the Japanese during the late war must have noticed that things were very bad indeed when a Japanese officer did not manage to get his hot bath. In Manchuria or their own country they never take cold baths, but we read of a Japanese officer coming off duty while a battle was still raging and taking cover from the shell fire to have his warm bath, which he very properly considered necessary if his health was to be kept up

during the campaign. Now, the bath naturally leads me to the consideration of the subject of drink on foreign service, and in my first lecture to you I had something to say on this subject, which I trust you have not forgotten. But apart from the subject of the introduction of disease germs, you will find, if you make extensive inquiries, as I have done, from those who have brought their health home with them after prolonged service in such a country as India, that they attribute their freedom from the all too common diseases brought home by our Indian veterans to the fact that they early decided that alcoholic drinks and the Indian climate don't go together for long. Beer is poison in India, and whiskies-and-sodas taken frequently between meals will sooner or later, and bit by bit, destroy the substance of any liver that ever tried to fight its owner's way through a few tropical summers. This is so important that, if you will allow me, I should like very much to tell you why it is so. Everything that is put into the stomach is absorbed by the stomach, or intestinal veins, which join to form what we call the portal vein. This vein enters the lower surface of the liver, and quickly divides up into minute veins and capillaries, so that the products of digestion may be acted upon by the liver substance. Now if you pour whisky into an empty stomach it is at once taken to every cell of the liver substance, and the action of these repeated doses of whisky on those tender cells is to set up an inflammation which, if often repeated, first hardens them, and then replaces their substance by a new and inflammation-created tissue. This means that the liver is no longer fit for its work; it has undergone more or less a change of structure. Of course, if it were all changed the patient would die from want

of nutrition, for food cannot be absorbed into the system until it has been changed by the liver substance. Now, the reason that drink proves fatal to so many residents in such a place as India is that the thirst is so great that if indulged the poor liver, whose work in warm countries is harder than in temperate climates, has no chance of escaping more or less of this change of structure if whisky-and-soda is not once for all avoided between meals. Fluid, of course, you must take in those climates where the skin gives off quarts of liquid per day, but if you take the advice of experience, and want to enjoy good health while on foreign service and come home well, you will resolve to look forward to alcohol when you see these islands again, and content yourself with lemon-squash, plain soda, tea, or similar drinks, to quench your thirst in such climates. And to fill your cup of bitterness I have to tell you that you must, if you want to avoid sickness, drink your tea or coffee without milk, unless you use tinned milk. Such unsweetened brands as the First Swiss Brand make an excellent substitute for the native article, which is rarely, if ever, safe in these countries, where enteric is endemic, and where natives think any water good enough to wash milk-cans with, even if they are not dishonest enough to add highly polluted water to your milk. Finally, on the drink question, if you want to keep safe from disease, don't forget what I said in my first lecture—no matter how thirsty, "don't drink between meals," and don't forget to put on your "British warm" as soon as the sun sets.

With this introduction as to safeguarding the general health, I can now pass on to consider how you are to avoid that greatest curse of foreign service—namely, malaria. This one disease is the cause of the

death of more than half of the residents who die in the tropics. It has prevented vast districts, otherwise desirable, from being inhabited by white men. It is rarely acquired in Great Britain now, but it may interest you to know that but a few hundred years ago it was an endemic disease in England, and that such personages as James I. and Cromwell died of it, and that there are still occasionally cases contracted in the Fen District of England. Thanks mainly to the patient labours of Major Ronald Ross, Indian Medical Service, the disease is now preventable. I don't know if many of you realize what this statement really means; you who have been long on foreign service do, but as Major Ross's discovery means that the army can be used in time of peace to conquer disease in His Majesty's dominions in a manner which was never thought of in the past, I propose, as shortly as I can, to tell you about the protozoon, or parasite, which causes malaria, and about his host the mosquito. The life-history of this organism is a little complicated, and I think the best way I can explain about it is to ask you to consider that we have a native of, say, the Gold Coast before us, and can examine his blood. He is, as they practically all are, at some time or other a victim of the disease in, let us say, its tertian form—*i.e.*, he gets an attack of malaria every forty-eight hours. I must ask you to have a little patience with me in following these stages, as, unless you do, you will not see the importance of the different steps which I must point out, and which must be properly followed if you and the men under your charge are to escape malaria altogether; and, gentlemen, if you and other officers of the army will only pursue this war with mosquitoes and their parasites, I venture to predict that in less than twenty years malaria will be completely driven off every land over which

the British flag flies. Now let us return to our infected negro. A large proportion of his red-blood corpuscles contain in their interior a small parasite which grows and feeds on the contents of the corpuscle. The corpuscle itself becomes swollen and a little pale, and as the parasite grows it forms in its interior a number of smaller bodies called spores. When the parasite is fully grown, a process which takes forty-eight hours in the tertian fever and seventy-two in the quartan, the red corpuscle bursts and sets the spores free in the plasma of the blood. When these are set free a furious fight sets in between them and the white corpuscles, and the patient is most uncomfortable and in a high fever. The spores which survive this battle, which few of them do if your plasma happens to be dosed with quinine at the time of the fight, attack the red corpuscles and start the same cycle over again. One parent parasite produces from six to twenty spores. But, in addition to these spores, which can only set up one asexual cycle, the parent cell gives off a fewer number of what are called sexual cells; both male and female. These can develop no further, they swim about free in the blood of our negro. Now comes along a hungry female mosquito of the genus *Anopheles*. You will know the dangerous female by the fact that they have a habit of apparently standing on their heads—and also by the fact that the anterior edges of their wings have a row of spots on them. It is an interesting point that it is only the female who sucks blood: the male is content to live on fruit; and if you are interested in knowing which is the dangerous female and which is the male, you can know one from the other, if you see them closely and at rest, by the fact that the male has hair—whiskers—on the antennæ or “feelers,” which are placed on each side of the head. The female’s antennæ are bald. She sees,

or smells out, the native, lying, as usual, unprotected by a net or curtain, and she at once lights on him, and looks for a suitable place to make her puncture. When she has found this she stands up on her head and looks most business-like. She sucks her fill of blood, and in that blood she obtains, if she is to become a source of infection, both male and female gametes, or sexual cells. In the stomach of the mosquito these cells at last feel at home, and the male, for the first time in his life free from the attentions of the white policeman, proceeds to grow flagellæ, and swims about gaily till he finds a female cell, which he promptly impregnates and becomes one with. The fertilized cell, or "zygote," as it is called, now wishes to get out of the stomach, and with this object in view penetrates the stomach wall of the now suffering mosquito and settles in its muscular fibres. Here it grows and forms in its interior a number of cells called spore mother cells. It takes at least seven days to grow to its full size, and then bursts into the body cavity, where the spore mother cells are set free, and a large number of them settle in the salivary gland of the insect, where they are ready to be injected into the next victim when the mosquito gets to work and starts her syphon to pump up her next feed of blood. These cells are the parasites of which I told you when I commenced the cycle on our negro. And now let us suppose that the female, hungry again, takes a fancy to one of you here, or one of your young soldiers only just arrived in our malarial district. The very same cycle repeats itself, and you, the white man, are now not only a victim to malaria, but a source of infection to your comrades, per mosquito bite only. Let us now return to "the plan of campaign" I laid down in my first lecture upon which to con-

duct our fight against disease. What can we do to fight malaria in its haunts? Here we had best attack mosquitoes in their breeding-ground. You will, of course, meanwhile kill at sight any mosquito who dares to stand on its head in your presence. But with regard to the breeding-ground, I should tell you that mosquitoes, like gnats in this country—gnats, in fact, are only a variety of mosquito, and you would not be wrong if you called them mosquitoes right away—lay their eggs in water, and that in their larval stage the young must come to the surface to breathe. The *Anopheles* species, which convey malaria, fortunately prefer shallow, stagnant pools to breed in. Now if you drain these shallow pools you will kill them by thousands, and I may tell you that it was by drainage that malaria was driven out of England. If you cannot drain them, you can still kill the larvæ off if you pour paraffin oil over the surface of the water, because when these creatures come up and ask for air, if you give them paraffin, or kerosene oil, or, indeed, any oil, they at once die. But I shall be told by some of you, who possibly have had experience in such malaria plague-spots as Delhi, or who have heard what some of the R.A.M.C. or Indian Medical Service officers have said on the subject, that to talk of drainage, or doing away with malaria by oiling pools, is to show ignorance of the real state of the case, as the task, they say, is impossible. Everything is impossible to those who fold their hands and won't try anything that is hard, but the following letter from Major Ronald Ross will, I think, convince you that what I urge you to do is well worth doing :

" LIVERPOOL,

" November 2.

" SIR,

" Statements have frequently appeared recently in the press to the effect that the antimalarial measures at Ismailia, Habana, and elsewhere have not really had the success which has been attributed to them. For example, Colonel H. Hamilton, C.B., I.M.S., Hon. Surgeon to the Viceroy of India, says in the current number of the *Indian Medical Gazette*: 'I know that Ismailia will at once rise to the lips of champions of mosquito brigade operations. But the chief measures were drainage and filling up pools, and if it is claimed that the improvement effected is the result of the destruction of mosquitoes, then I must say that my experience going through the Suez Canal last December leads me to doubt it. Mosquitoes abounded everywhere, and particularly in the neighbourhood of Ismailia, and I was much struck by their aggressiveness during the day—no doubt *stegomyia*—whilst at night they made sleep impossible.' This is an example of the kind of statements which continue to be made on the subject. Ismailia is about a mile from the Suez Canal, and the antimosquito measures carried out at Ismailia were not extended to the whole banks of the canal, so that a ship passing through the latter might easily pick up mosquitoes anywhere *en route*. Colonel Hamilton does not appear to have visited Ismailia itself, but permits himself to infer without hesitation that mosquitoes continue to abound there, notwithstanding statements to the contrary, because he found them to exist along the canal! In order, however, to obtain further information, I wrote to the secretary of the Suez Canal Company on the point, and now beg to enclose his reply, which, I think, will serve to dispose of Colonel Hamilton's

criticisms. The fact (noted by the secretary) that the insects tend occasionally to reappear, and that success can only be maintained by *une surveillance constante*, is, of course, only what we must always expect. Similar statements have appeared about Habana, based apparently on facts evolved in the inner consciousness of the writers, who seem to be entirely ignorant of the able monthly reports of the Board of Health of Cuba issued by Dr. Charles Finlay.

“ I am, etc.,

“ RONALD ROSS.”

(*Translation.*)

MALARIA AT ISMAILIA.

“ PARIS,

“ October 27, 1905.

“ MONSIEUR LE MAJOR,

“ In your letter, dated the 24th of this month, you have asked me what value ought to be attributed to the assertions published in the Indian press as to the reappearance of mosquitoes and malarial fever in Ismailia.

“ I can inform you that the sanitary campaign carried out at Ismailia continues to give the most satisfactory results. From statistics prepared by our medical officers it appears, in fact, that from January 1 to the end of September, 1905, the total number of cases of malarial fever recognised among the agents and workmen of the company, as also among their families, only amounted to thirty-seven, and it has been recognised that all these cases are only examples of recurrence.

“ Further, during the year 1902, the year preceding the organization of the antimalarial campaign, the number of cases of fever observed was 1,990, in 1902 (defensive measures commenced in September) it was

1,548, in 1903 it was 214, and in 1904 it was 90. It is true that on different occasions during this year the presence of mosquitoes, *Anopheles*, or *Culex*, has been in the town and its environments. But owing to the attentive and permanent supervision of the habitats of these insects, and the rigorous applications of proper defensive measures, their disappearance on each occasion has been rapid. It may therefore be said that, in spite of the momentary appearance of mosquitoes, malarial manifestations at Ismailia show a continual decrease. But this happy result can be obtained only through constant supervision (*par une surveillance constante*) by the destruction of the insects as soon as their presence is recognised, and by the methodical labours of the sanitary corps. I may add that the distribution of quinine as a preventive measure is carried out at the same time with the greatest regularity. Will you accept, Monsieur le Major, the assurance of our very distinguished consideration.

“ LE SECRÉTAIRE-GÉNÉRAL,

“ LE SECRÉTAIRE DE LA DIRECTION,

“ MAX BERTRAND.”

Now, gentlemen, I think that what has been done in Ismailia will show you what can be done elsewhere; and as to Delhi, where, I am told, that, owing to the flooding of the Jumna, doing anything at all is out of the question, although the garrison from the fort there come out broken with malaria every year, or other similar stations, I think that there is in such places a great chance for an officer to earn the everlasting gratitude of generations of soldiers by finding a way out of this difficulty. It does not require a man to go through a five years'

course of medical studies to enable one who, by the very commission which he holds, is already a sanitary officer, to consider how he can best destroy the plague of mosquitoes when he knows what harm these pests do. Indeed, I believe the combatant officer to be the best sanitary officer if he can be got to take the trouble. By way of suggestion as to what might be done, if you cannot drain a district, I might say that I found at home that the introduction of a few sticklebacks quickly cleared a pool of the larvæ of midges. I don't know what natural larvicides might be found in the course of an early morning walk in India by the rivers and pools there. But perhaps the idea of exporting some hardy fish such as sticklebacks or minnows is worth pursuing, and some day, perhaps, we may hear that you have had to add to the other duties of the orderly officer that of seeing that the sticklebacks are properly, but not excessively, iced while passing through the Red Sea and the tropics. In any case when dealing with malaria, if we want to really conquer it, we must attack it in its breeding-ground. Conquest by means of little fish, although I believed the idea to be original when I first thought of it, is, I find, by no means so. The Americans have, I have since learned, sent fish to Penama, and these fish have helped materially in the victorious fight carried on there. If we cannot drain or use fish, or, if conquest in that direction will, as it must, take time, what steps can we take to prevent the enemy landing in our territory? Here we can do much, and first of all it is well to know that our enemy never, unless she is disturbed, stirs out by day, and rarely, if ever, tries to feed except at night. Therefore we send our sentries out on duty at night with mosquito-nets properly fixed. This is not unheard of in an army; the Japanese have

already taken this precaution. We sleep in rooms protected by wire-gauze doors and windows, or under a punkah, or, if this is not in working order at the station, with a perfectly fitting mosquito-net or curtains. I know they are uncomfortable in hot climates, but they are not so uncomfortable as malaria. But supposing, notwithstanding our precautions, the enemy does effect a landing—are we powerless? No! If you take 5 grains of quinine every day the parasite will not be allowed to develop in your blood. This, however, most of you will not continue to do, as 5 grains daily for a long period nearly always upsets the taker in this dose, and unpleasant consequences, such as headache, singing in the ears, etc., follow. It has been found, however, that, as the parasite takes time to develop in sufficient numbers to cause malaria, 10 grains taken for two days running, with an interval of eight days between the doses, will insure that there is enough quinine present in the blood at the right time to prevent the development of the disease. An eight-day interval gives time for the effects of the quinine not to prove unpleasant, and the only objection is that eight days brings “the quinine day” a day later every week, and hence it may be forgotten just at the very time when the enemy gets loose. It has been found by experience, however, that when taken regularly in this way it does generally prevent an attack, provided the digestive organs are kept in order, so that the quinine is absorbed into the blood, and not rejected by the stomach. Quinine should be taken immediately after food, and not between meals. It is quite useless, because not absorbed, if given to a man suffering from indigestion or constipation.

Well, gentlemen, having told you how you can, if you will take the trouble, avoid getting malaria, I need not

trouble you about the different forms which the disease takes. I may mention that there is a malignant type of fever, and that in this type when the parasite gets into the corpuscle it causes it to shrivel up and become black, and the patient quickly dies. And I should mention that there is what is called a quotidian type, otherwise some of you who may have had this may wonder if you ever really had the right thing at all. This apparent contradiction to what I told you before is explained by the fact that the patient who gets this fever every twenty-four hours is really suffering from the effect of being foolish enough to have allowed two mosquitoes to infect him on two successive nights.

Before I pass from the subject of our war on mosquitoes I want to say a few words on the subject of yellow fever. This fever has been endemic in Havanna and Panama, and in many parts of the West Indian Islands. It is conveyed by the bite of a mosquito generally known as the tiger mosquito, from the fact that he, or she rather, is striped black and white, and if you look at her closely she is really rather a pretty object. Recent experiments at Panama, from which district this dread plague has been stamped out, have proved that the tiger mosquito is the *sole* means by which the cause of yellow fever is conveyed from patient to patient. The position with regard to yellow fever is a very interesting one, inasmuch as, although we are quite sure that a micro-organism is, and must be, the cause of the disease, nobody has ever seen this deadly villain. He may be too small, or it may be that he does not react to any of our staining agents, but in any case the fact remains that we know he exists and how he is conveyed about, but that is nearly all that we do know about him. We must, therefore, continue our war on mosquitoes when-

ever we are in a place where yellow fever has found a home; and about the breeding place of this mosquito, I should tell you that it prefers a water-barrel, or an old tin kettle, or any artificial collection of water to breed in, so that, of course, as a natural consequence, such collections of water must not be allowed to exist, and if they are required for other purposes, should be covered over and watched.

Elephantiasis, too, a disease common amongst natives in parts of Africa, is carried about by mosquitoes; and lastly, I should tell you that the horse disease known as "horse sickness," and probably many other diseases of horses, are conveyed by these pests, or by other flies with which I want you to wage war. Whenever you have the means of preventing any sort of fly from breeding, as you so often have if you will only take the trouble, first learn where they breed and in what substance, and then *think* how you can prevent them from having access to their favourite breeding-grounds.

I pass to a disease which was long confounded with malaria—namely, Malta or Mediterranean fever. This disease, sometimes called Rock fever of Gibraltar, is common in Mediterranean ports as well as in hill stations in parts of India, and, therefore, is of importance to us, as, if you are not likely to be sent to them just now, your friends are always there, and any day you may hear of one of them being down with Malta fever. Very few people—not more than 2 per cent.—die of this fever, but it is prolonged, and often goes on until the patient is sent home out of the station. It is caused by a specific micro-organism, generally in the form of a coccus, which is often double. The disease is common in goats, and it has been proved that the milk from fever-

sick goats swarms with the micrococci, and that men and animals fed on this milk are liable to take the disease. So far investigators have failed to point to any other source of the fever. This is the result of recent investigations, and I should tell you that these investigations are not closed, nor is it admitted yet that goat's milk is the only source of infection. It is, however, proved that it is a source of infection, and I fear that you will smile at the members of my profession when I tell you that up to the time when this discovery was made the usual treatment for the disease was "milk diet and quinine." Milk diet in Malta meant goat's-milk diet, so that, of course, for the poor patient who submitted to his doctor's orders it was a case of the "last state of this man being worse than the first." The preventive treatment is, of course, to avoid milk in these stations, unless the milk has been boiled, or, better still, been pasteurized—*i.e.*, heated sufficiently under exact observation. I, however, repeat here what I said at the opening of the lecture—*i.e.*, that I do not consider any untreated milk worth the risk involved in taking it on foreign service, especially since the means of condensing milk in an absolutely pure, unsweetened form are so perfect.

With this remark I pass from the goats of Malta and Malta fever to another fever, for a long time, and, indeed, up to quite recently, confounded with malaria—*i.e.*, relapsing or tick fever. This fever is undoubtedly caused by spirilla introduced into the blood. A species of tick has been proved to be the cause of this fever in Uganda, and similar ticks have since been proved guilty in the Congo and in India. These investigations were made as late as 1904 and 1905, and may be said also to be not yet completed. That is to say, bites of other insects may

also introduce the organism. It is a very important discovery, as relapsing fever, always, I may say, taken to be a species of malaria, with which it is now clear it has nothing whatever to do, is a common disease amongst whites living long in these districts. It is an interesting fact historically that this disease was very common in Ireland amongst the famine-stricken peasants of the poorer parts of the country during the famine years. We never hear of it now, although ticks are perfect pests upon foxhounds, to which they give a disease—possibly relapsing fever—which is as yet but ill understood by us. When you know the cause the prevention is easy, and may be summarized in the words: Take the very best of care that your own sacred person is always protected by flea-powders and clean beds from the attentions of these pests, and remember that much can be done by washing with strong carbolic soap to kill the tick. A tick, by the way, is a very slow feeder, and in your hours of wakefulness you would not be likely to tolerate his presence long. Those of you who have seen service in South Africa must have seen these ticks fastened now and again between the thighs of your horses. This is the very same gentleman who conveys the spirillum, which, as you will see from the picture I show you, is a comparatively—that is, when compared with a bacillus or micrococcus—very big invader. The round cells in the picture are blood corpuscles. These organisms live in the blood until somehow they get collected in the spleen, when the white corpuscles eat them up, and the disease ends, for the time being, by crisis. One hint for the sake of your best friend, the horse: don't pull the tick off him, as this leaves his suckers in and causes a sore. Wash the parts affected with carbolic soap, then the tick will drop off.

The mention of the word fleas—flea-powder—in this connection reminds me that I must tell you something about Plague. I do not intend to delay you long upon it, as I look upon plague as a “dirt disease” which ought never to be allowed to spread to a white man. This disease, as its full name—bubonic plague—suggests, begins with great swellings of the glands nearest to the seat of infection. It can only get into the system through wounds, cracks, or abrasions of the skin. Rats are very susceptible to it, and have generally been seen sick before and during an outbreak. The bacillus of plague has certainly been found on the fleas of those sick rats, and as the fleas desert the dying rat when he gets too cold to please them, it is more than probable that the bites of fleas form one of the commonest ways in which the disease is conveyed to man. The bacillus lives in the polluted soil, and may also be conveyed through a sore on the foot or cracks in the skin of an ill-dressed and dirty-living native. To avoid plague you have only to keep fit and clean, and have as little as you can to do with the native quarters, their rats, and their fleas. But even if you are so unfortunate as to have to run the risk of getting this dirt disease, Dr. Klein, whose reputation is world-wide, and who has never stated anything which subsequent investigations did not amply bear out, has just announced that he has prepared a thoroughly trustworthy material from guinea-pigs dead of subacute plague, so that in future, less than ever, need a white man get plague. As you know, this disease is endemic in some of our largest towns, as well as in many country parts of India, and the native, with his objection to killing or even kicking a rat out of his house (I believe he thinks the rat may contain the soul of his dead father or mother), and his

objection, on religious and other grounds, to personal hygiene, will not allow the necessary steps to be taken to stamp out the disease. The bacillus of plague, like all pathogenic organisms, curls up at once and dies if you let the sun shine upon him. Plague in the old days resulted in cities being deserted, and whenever you meet a city in your travels still standing, but deserted by its inhabitants, you may be sure that the inhabitants ran from some pestilence after a large number of their members had been killed off.

Cholera is another great cause of the desertion of cities in Asia, the home of cholera ; and with regard to the prevention of this disease, which I also look upon as a thing of the past as far as white armies are concerned, you have only to remember what I told you *re* the prevention of enteric. Cholera is also a water-borne disease. Indeed, the bacillus of cholera dies in two or three minutes if it is dried. It multiplies rapidly on moist linen, and in this way may be spread by common washing-places ; but you may take it that if you look after your water-supply, and don't eat any food washed by dirty water, you will not get cholera. The sun, too, is fatal to this germ, and he really only lives outside the body in dark, damp spots and in water, where it has been proved, although it does not multiply, that it can exist for months. So, with regard to plague, let me remind you that " fleas allow no rest, and should be allowed none " ; and with regard to cholera, where it is endemic, avoid water, unless you *know* that it has been boiled, unless you want to introduce death to your own body and those of your own comrades. And don't even bathe in dirty baths, for fear you might swallow some of the foul water. A case of cholera occurring in a regiment should be immediately followed by an inquiry, as cases

can only occur where men are guilty of either wilful or, in a hygienic sense, inexcusable carelessness.

I now pass on to deal with a very important disease, the last to which I propose to ask you to give me your attention. That disease is Dysentery. It is a most important disease, from a military point of view, as, next to enteric, it caused the largest number of admissions to hospital in South Africa. What is called dysentery undoubtedly consists of at least two quite separate diseases—that is to say, diseases which have different causes, but which are the same in symptoms. One of the commonest forms, I am convinced, is caused by a bacillus, first described by Shiga of Tokio, and called after him. This disease, all evidence indicates, is purely water-borne, and therefore can be prevented by the same methods as I told you of when speaking of enteric in my first lecture. The bacillus of Shiga is like the enteric bacillus in a great many ways, and like it, too, it is killed, for the most part, if taken in water with food. With regard to the other, or amœbic dysentery, I cannot speak with much confidence yet. That an amœba causes the dysentery is certain, and that this dysentery is of a very severe form, and but too often followed by abscess in the liver, we know ; but as yet we know nothing of its life-history outside the body, and therefore we cannot say how it gets into the intestine. It is worthy of note, however, that this form of dysentery always appears to start amongst troops which are encamped on foul and much-used camping-grounds. Further, it has never been known to start amongst troops as an epidemic unless diarrhœa has first been epidemic amongst them. Therefore, as a preventive measure, I can only suggest that, in the first place, you should teach your men that they should regard it as a

point of honour for the safety of their comrades at once to "go sick" if they have even slight diarrhœa. The isolation of these men in hospital may save an immense amount of subsequent sickness, and possibly death. Again, I would suggest to you that if this great danger-signal, diarrhœa, does break out in your camp, you should at once strike camp, and if the illness does not stop, hold a court of inquiry, with the assistance of the medical officer, and try to get at the cause of the evil. *Remember that no sickness ever came without a cause.* As another possible means of the introduction of the amœba of dysentery, or of the causes of irritation setting up diarrhœa, into the digestive tract, I would suggest that the habit which men have of eating their food (with probably dirty hands and nails) off ground which they have used for a series of nights before as a urinal, under the cover of darkness, may have something to do with the unsatisfactory result; and as in my next lecture I intend to treat of the subject of personal and camp hygiene, I should like, with your permission, to stop here for to-day.

LECTURE IV

The predisposing causes of disease—Training—The advantages of deep breathing—Constipation—How prevented—Uses of permanganate of potash—Our camps in the Crimea—Camp sites fouled by urine—Notes on camp hygiene—Fæces the favourite breeding-ground of flies—The Russian military medical service—Surgeon-General Havard's report—Baths in war-time—The ration biscuit—Conclusion.

GENTLEMEN,

We have now come to the final stage of my campaign against disease and death. In my former lectures we passed in review the *direct causes* of all the commoner diseases which, apart from accidents, result in placing the soldier—and, indeed, the public generally—*hors de combat*. But before I can be considered to have completed my task it is absolutely necessary that I should say something of the *predisposing causes* which lower the vitality of the tissues generally, and of the white corpuscles particularly. It is all very well, some of you may think, for me to say that all these diseases have been proved to be caused by micro-organisms, but how do you account for the fact that three men escape where only one sickens, although all are exposed to exactly the same influences? To those who are inclined to ask this question I would reply that I hope that you have not forgotten what I have told you *re* the fighting-powers of the white corpuscles, and of the necessity of keeping them ready for war. Anything, then, that lowers their vitality is a predisposing cause

of disease. Disease germs, although they have their favourite *habitat*, as we call it, spread about in the most extraordinary manner once a disease becomes epidemic, or already is endemic in a country. You remember what I told you about the general distribution of the pneumococcus, and yet how far you have to go out of your way to get an attack? It may interest you further to know that, although we cannot always trace how the germs get about, yet it is nevertheless true that, whenever a case of diphtheria occurs in a crowded house, the bacillus of diphtheria can be isolated from the noses and throats of a considerable number of the inhabitants of the infected house, even from some immune children of the household. That this is not fancy is proved by the fact that the inoculations of cultures made from these healthy individuals will kill rabbits or guinea-pigs with all the symptoms of diphtheria. The fact that these healthy people are not also victims of the disease can only be explained by remembering the powers of resistance possessed by all living beings in a greater or lesser degree. Personal hygiene aims at raising the powers of resistance to the highest point consistent with the circumstances under which the individual has to live, and is really, as I told you in my opening lecture, nothing more nor less than a scientific training of the human body. What does this training, then, entail? you will naturally ask. In general terms I told you in my first lecture, but now I have to go a little more into detail. In the first place, anyone who wishes to keep really well should sleep with an open window to their rooms both winter and summer. If it is cold, have extra blankets, but don't, at night above all times, take into your lungs carbonic acid and microbe-laden air. Next, sleeping or waking,

always breathe in and out through the nose, except when taking violent exercise out of doors. The mucous membrane of the nose is your first great microbe-trap, and in addition to this it raises the temperature of the air before it gets into the lungs. This is most important in crowded rooms, where microbes are bound to be going about, to a more or less degree, according to the healthiness or otherwise of the community with which we mingle. Sleeping with the mouth open, and hence breathing through it and snoring, is a bad habit, from the point of view of health, and is best cured by repeatedly trying to keep the mouth shut in bed before going to sleep. In the morning the complete emptying of the lungs by a series of deep breaths should always be practised while dressing. In doing this it is most important to empty the lungs completely by not only forcing down, the diaphragm, the great muscle of respiration, which acts by contracting downwards in the abdominal cavity, but also by forcing it up and the ribs in, or, in other words, making the chest as small as possible, and thus emptying as completely as possible the air-spaces in the lungs. Forcing the diaphragm down, while at the same time the muscles in the front of the abdomen are held tense, is a splendid health-preserving exercise, as it really massages the liver and other contents of the abdominal cavity. Of course, these exercises are performed by you every day when you go on parade, although you may not notice the process; but if, in addition to this, you practise them as you get up, you will find, not only that you feel better and fitter, but, owing to the importance of their being done immediately after the night's sleep, you will begin to look better, for a really healthy state of the blood soon shows itself in the face.

The next point I have to bring under your notice—the necessity for a daily bath—is one that I need not dwell upon while speaking to officers, except to say that, while officers know that they must have their baths at all costs, the same necessity is not always admitted with regard to the men, even in time of peace. In war-time, of course, baths are luxuries which we must be fit enough to be able to do without, if necessary. On this point, then, I may say that, together with the kidneys, bowels, and lungs, the skin is important as an excretory organ, and that if the pores, which it is covered with all over, are kept open, it daily gets rid, even without any exercise to help it, of at least 2 pints of waste material and water which otherwise would help to poison the body. On days when heavy exercise is taken the skin gets rid of far more than this, and so relieves the kidneys of this extra work. There is nothing, then, so important for health as a clean skin and plenty of exercise to stimulate it to action.

After the bath comes breakfast, and here I must give you a general and most important direction for all meals. Chew and rechew all food repeatedly, so as thoroughly to mix it with the alkaline saliva. This stimulates a free flow of the acid gastric juice, which not only digests the food properly, but also kills a considerable number of germs, which may have been introduced with the food.

The next point is a very important one, and one often neglected by the young soldier. No animal body can remain long in health unless the inner surface of the body is kept clean by a regular and daily evacuation of the contents of the bowels. Man, indeed, is the only animal—with the exception of some domestic animals whom he has trained to do likewise, and who also suffer

much from sickness, unlike the wild animals, who are practically never sick—who does not at once obey the call of nature to empty the bowel, and in the excitement of a busy morning, both in peace and war, soldiers too often neglect themselves, and put off this most important duty of the day. Let me tell you why this is so important. In the first place, if retained in the lower bowel, some of this fæcal matter is reabsorbed into the circulation, where it acts as a depressant, and lowers the fighting-power of our white army. In the next place, there is in every healthy intestine a certain group of bacilli called *Bacilli coli communis*. If the fæces are retained, these bacilli multiply so excessively that they may even set up diarrhœa, and are believed by many to be the most common, if not the sole, cause of the fashionable, but most unpleasant, complaint, known as appendicitis. They certainly always swarm in large numbers round and in the inflamed appendix, when this disease goes on to require operative interference, as it so commonly does. It is certainly remarkable in how many cases of appendicitis we get a previous history of irregular action of the bowels, or of actual constipation. Indeed, an intestinal tract that is properly emptied every day at the same hour I do not believe ever behaves so badly to its owner as to allow inflammation to be set up round the appendix, much less to go on to the stage of suppuration. How, then, are the bowels to be kept in regular order? The quality of the diet, which should be well varied with a mixture of vegetables, combined with regularity and moderation in all things, is the best way to secure this most desirable of results. Should, however, circumstances not permit of these precautions being taken, and the bowels become confined, or inclined to be that

way, I often recommend a tabloid made up by Burroughs and Wellcome, called "Aloin Compound," to be taken with dinner. This tabloid, which consists of a small dose of the active principle of aloes (the active principle being free from the objections to the use of aloes itself) combined with still smaller doses of strychnine, belladonna, and ipecacuanha powder, which act as tonics to the nerves and coats of the intestines, and increase their movements, without having any subsequent ill effect, such as the taking of drastic purgatives always has, will be found most useful to those who find difficulty in observing the regularity of their morning visit. I want the men also to take a note of the name of these tabloids—Aloin Compound—which they can get at any chemists, as I know that many of them waste a good deal of their money on patent pills, most of which are more or less harmful, if taken habitually, or upon so-called Fruit Salts which if taken, often or in large doses, lower the tone of the coats of the intestines, and predispose to disease. I think this tabloid, or some vegetable laxative, should always be taken when encamped in old camping-grounds where there is much sickness, and it will also be found to add to the enjoyment of life by those who like to dine, and drink with their dinner, not wisely, but too well. As I have said much about the avoidance of alcohol during this course of lectures, I should like to add that, provided the wine is good, and the quantity moderate, it is unobjectionable, from a medical point of view, if only taken with dinner.

You will, perhaps, have noticed that in the course of these lectures on Preventive Medicine I have recommended three drugs, and only three, and these three, I think, should always be kept handy by anyone

who wishes to keep out of the doctor's hands. They are :

Permanganate of Potash—Crystals or Tabloids.

Sulphate of Quinine—5-grain Tabloids.

Alcin Compound—Tabloids.

Now, when I recommend you to carry about permanganate of potash, and I have already recommended it for a certain class of disease which shall be nameless, I fear that you may be inclined to take offence, and tell me that I forget that I am speaking to respectable married men. Gentlemen, there is no need to be offended. Permanganate of potash is the best preventive of a cold, if a hot gargle of it is used and well gargled up into the back of the nose in the early stages of a cold or sore throat. If you get a cut there is no dressing like a good washing with hot water which contains permanganate of potash in solution. On foreign service, if applied quickly enough in solid crystals, it is an unfailing preventive of poisoning from snake-bites. Indeed, all wounds received in tropical countries, where the clay is full of the germ of tetanus, should be immediately washed with a solution of permanganate of potash. And last, but not least, if you are big-game shooting, and are unfortunate enough to get "mauled" by a tiger, you are practically sure to die, if the skin is at all torn, unless you have a friend quickly to wash the wound with a strong solution of permanganate of potash. Big game seem to go about with their claws crawling with tetanus and suppurative germs of the most virulent kind.

But I fear that telling you how to treat wounds of infuriated tigers can hardly be described as personal hygiene, so with the excuse that possibly the hint may

be of use to some of you I return to my horses. I have only two points more on the subject of personal hygiene, and these are, first, that the men should be encouraged to be as particular about the care of their teeth as are their officers; and, second, in warm countries especially, they should be equally anxious, whenever at all possible, to wash their hands before meals, and especially "after stables." With regard to the first hint, I will only say that many a wandering microbe has been dislodged from between the teeth by the application of a little carbolic tooth-powder; and with regard to the second, if you wash your hands before eating, you certainly prevent the invasion of many an organism, which otherwise might be strong enough to cause you to call up all the forces of your white army. This precaution is especially necessary in the case of cavalry soldiers, as, although cases are fortunately rare, yet such diseases as actinomycosis, glanders, anthrax, and many forms of skin diseases and parasites have been transferred from horses and other animals by means of hands which have not been washed before food was partaken of, or by means of germs having obtained a lodgment under what is known as the "black of the nail," and been transferred into the mouth in the process of biting the nails. This, by the way, is a very bad habit if indulged in with dirty hands, as germs of disease may very easily, by this means, be introduced into an empty, alkaline stomach. The Japanese medical officers are very strong on this point as a means of spreading disease, and even at the front they constantly hold nail inspections of the men, and take no end of trouble to see that their nails are kept clean and properly trimmed. They must have had good reason for taking this trouble, and I propose during the year to follow up the point by making

cultures from some of your finger-nails under the different circumstances of barrack, camp, and manœuvre life.

And now let me pass on to what is generally called camp hygiene. I fear, gentlemen, that when you hear the words "camp hygiene" you will immediately allow your attention to wander off, as you will expect me to worry you about the parts and action of filters, common-places about latrines, and the usual admonition about the necessity of keeping your lines clean. Gentlemen, I am not going to do anything of the sort. I am going to tell you something about the Crimean War first, and from that I am going on to tell you something about a general order issued 3,357 years ago by a great leader of men and women, called Moses, the first great authority on camp hygiene, and of course upon other matters of less importance to us just now. When I have told you what Moses did, or ordered, I propose to go on and tell you what the Americans have lately done, and what the Russians did in Manchuria, and then I shall leave you to draw your own conclusions.

Let me, then, tell you something about our camp in the Crimean War. No ; let me first of all tell you that during the first winter of that war (1854-55), of every three men who left our shores to fight for us, just one was dead of sickness before the winter was over. Just realize this—one in three dead of sickness ! Naturally, there was a howl in England when the people realized that even if not a single man was killed in action, the whole of their gallant army would soon be numbered amongst the dead. In the spring of 1855 a sanitary commission was sent out, consisting of two doctors and one engineer. This commission found tents that were never ventilated, pitched upon ground upon which no attempt at drainage had been made. They found an

old graveyard chosen as the camping-ground of regiments, who preferred to live—or die—there than to walk 200 yards further on to a healthy site. They found latrines which were not more used than were the trenches from which the men fought for a similar purpose. They found the army badly fed and clothed, and cooking amongst many of the men unthought of. To quote from Lord Wolseley's "Story of a Soldier's Life,"—"we never had enough to eat, and what we had was never appetizing. What killed our men most was lack of firewood, so that we began to eat our salt pork and red navy junk in a partially uncooked state." So badly, indeed, were things managed, that Lord Wolseley goes on to express the hope that in the next world "the political gentlemen may be the slaves of the noble spirits who died of want before Sebastopol." The commission, however, had power to give orders. They moved the camp, insisted upon properly-ventilated and warm huts being built where possible, and the sun let into the tents during the day. They insisted, almost upon pain of death, that the calls of Nature should be relieved in the latrines, and nowhere else, and they organized a cooking department in the various sections; they even got French *chefs* sent out to teach cooking to the men. They also ordered warm clothing to be sent to the front with all speed. The result of their labours was that in the second winter, with an army of 50,166 men in the field, we only lost in death from sickness 551 men. And the whole of practical hygiene is contained in the recital of the few things this commission did—that is, if common-sense is the guiding principle, and different circumstances are duly allowed for. Here, however, I think it is necessary to state that taking down a tent and putting it up a few yards further

on, with a view to airing the site, as I heard recommended in a lecture on Military Hygiene which I attended, is, in my opinion, a mistake, for the following reason : At present our men do not appear to know that the custom which they indulge in of micturating a few yards from their tent-doors, under cover of darkness, is a very bad habit. If, therefore, you move your tent a few yards, you just move it on to a place which has been fouled by urine some nights before. So that my advice is, if you take down your tent for the purpose of airing the ground underneath it, see that it is put up in the very same place, or, better still, move your camp altogether to a fresh site. But about this bad habit of micturating within the camp, I need to say something ; it will lead me up to what Moses said. I have often been told by officers, medical and otherwise, that it is, like my first difficulty about drinking dirty water, a hopeless task to attempt to prevent. Gentlemen, I say that you *can* get the men to give up this habit if, first, you make them fully understand *why* they should ; and, second, by ordering that urine tubs be placed at intervals down the lines when night sets in—to be taken away, of course, in the early morning—you do away with the necessity of men going out of camp for this purpose at night. This last way of getting over the difficulty is so easy that I wonder it has not been always done in our camps ; and as to the first, you must be in a position when giving your orders about this sanitary matter, to teach the men the fact that fouling the camp with urine is dangerous to the health and lives of their comrades, because, when a man is fighting, say, an attack of enteric, his urine is often full of the germs of the disease. Passing these off in the urine, as well as the fæces, is one of Nature's ways of getting rid of the invaders. The

urine decomposes where it is passed, but the bacteria live on ; and if one of your men is unfortunate enough to sit on this foul spot and rest his hand on the apparently clean ground, he may very easily transfer the germs from hand to mouth, and an epidemic may, in this way, be started which will not stop until it has destroyed the regiment's good record for avoiding disease. For I predict that in future a regiment which has a high sick-rate, either in peace or in war, will earn the worst possible reputation for itself and its officers. And this brings me to what Moses said, which I quote in full, because I want to know why, if Moses succeeded in keeping his camp clean by publishing a " General Order " that the Great Creator of the universe was fond of walking about in the Jews' camp, and liked a clean camp (and possibly also because they knew that he would stone them to death if they did not keep it clean) ; and why if the Japanese succeeded in keeping their camp clean by giving out the idea that the spirits of their ancestors were hovering round their bivouacs (without even talking of stoning anybody to death)—why can't we succeed in getting our camps kept clean, because our soldiers know that death in the shape of pathogenic micro-organisms lurks wherever dirt is allowed to lie ? And at last, gentlemen, I can get in what Moses did say on the subject of latrines and micturating in the camp. Here it is, quoted from the Book of Deuteronomy :

" 12. Thou shalt have a place also without the camp, whither thou shalt go forth abroad.

" 13. And thou shalt have a paddle upon thy weapon, and it shall be, when thou wilt ease thyself abroad, thou shalt dig therewith, and shalt turn back and cover that which cometh from thee.

“ 14. For the Lord thy God walketh in the midst of thy camp, . . . therefore shall thy camp be holy, that He see no unclean thing in thee and turn away from thee.”

Now, the point of Moses about the “paddle upon the weapon” reminds me to tell you that, while the dry-earth system is in use in your camp, at home and abroad, your men should be far more particular than they are about “covering that which cometh from them.” They, perhaps, are not aware that human fæces form the favourite breeding-ground of the common house-fly, who will die undelivered of her eggs sooner than lay them anywhere except where the larvæ will have something to feed upon when the eggs come out. Therefore, our latrines breed millions of flies where none would be born were the fæces properly covered up. For that reason all latrines should have a cover to keep off the flies, and plenty of disinfectants about. Flies seem to know that the latter are bad for their offspring, and give them a wide berth. But, in any case, your latrine system is, to my mind, very much out of date, and particularly so for a country like India, where latrines are often not kept as they should be, and where your system of disposal of the contents of them is calculated, as time goes on, to create such swarms of flies that in the end nothing but flies will be able to live in the country. I refer, of course, to the shallow-trench system of disposal of night-soil, which manures the land splendidly, but also acts as a breeding-ground for flies in countless millions. I don’t know who decides what system is to be adopted, but I would strongly urge on any of you who may be consulted in this matter that you should advise the adoption of the system ordered to be used in the American Army by General Order No. 170 of the United States Army. An illustration would show you the arrange-

ment far better than any words, but I might explain that the whole arrangement is portable, in sections, and the trough is curved, so that there are no corners anywhere in which anything can collect. The trough is filled with a disinfectant, in solution; thus flies are afforded no opportunity of ever coming near the faces. There is also on wheels an apparatus into which the contents are evacuated by pumping in such a manner that none of the contents are ever seen, nor allowed to leak on to the ground. The adoption of this system does away at once with all your filth-carts and with all the dirty and degrading labour which your present system of latrines involves. Until, however, such a system is adopted you must only do the best you can to see that the dry-earth or open-bucket system is fully carried out, and its ill effects minimized as much as possible. Urinals should be separate from the latrines. You cannot have too many of these conveniences about a camp, and the tubs used for this purpose should always have a strong disinfectant in them; whilst about the general state of the camp—I am still telling you how you can carry out Moses' idea, "therefore shalt thy camp be holy"—if you want to keep your men in health, you should encourage them to collect all organic matter, pieces of disused meat, vegetables, etc., etc., and at once have them cremated. I should like to see wheeled refuse-destructors by the side of every camping-ground, and constantly in use. If you have not got these, refuse can be cremated by having a fire for the purpose at the lee side of the camp. A large heap of stones in the middle of the cremation spot will create a draught, and if the rubbish won't take fire properly, paraffin thrown over it, and then lighted, is never wasted. Organic matter always swarms with micro-organisms if

left about the camp; and in any case, even if these organisms were harmless to health, why should you feed those pests of camp life, the flies? Now about the state of your camp in war-time; I promised to tell you something of what the Russians did in Manchuria. You may remember that quite early in the late war we heard of the Japanese success in Preventive Medicine. At the same time the newspapers here occasionally contained paragraphs telling of a horrible state of things with the Russians. These stories were received with surprise, and, indeed, I may say incredulity, by those of us who knew that the Russian Medical Service was—on paper, at all events—very efficient. Russian military medical officers are, in time of peace, the surgeons and physicians who take charge of the civil hospitals in that country. Their military hospitals are under the executive command of an officer of the line, and thus these surgeons are not expected to waste their time learning a second profession in addition to their own. You do meet men, of course, but they are rare, who are both physicians, surgeons, soldiers, and sanitarians, all at once. The Russian military surgeons are left to do their own proper work, and they are, by all accounts, splendidly backed up in sanitary matters by the officers of the line. I read, for instance, of the following order being issued by Lieutenant-General Nadaroff, Commander-in-Chief at Harbin :

“ I beg Lieutenant-General Kugel, Commandant of the Hospitals, to enjoin upon the directing personnel of all hospitals strict compliance with these two fundamental rules :

“ 1. Hospital buildings should be kept even cleaner than my own quarters.

“ 2. The hospital linen should be kept cleaner than my own.

“ The rest accordingly.

“ In general I desire that business on hand deserves the chief attention, while paper work should occupy a secondary place.”

This order would be out of place here were it not that, although I have not got a copy of the General Orders issued at the front, I am quite sure from what did take place there that they were, on sanitary matters, much the same as General Nadaroff's order. For here we find—I now quote from the report of Surgeon-General Havard of the United States Army, Medical Attaché with the Russian Army in Manchuria—that “ the camps in Manchuria were kept clean, most of their area being swept every day, and the garbage being either burned or buried.”

“ Each camp, if somewhat permanent, had a bath-house, for hot water and vapour baths, but such bath-house was necessarily crudely equipped.”

“ Most of the food and drink of the Russian soldiers are so prepared that they cannot transmit infectious germs.”

“ All the ration, bread excepted, is thoroughly cooked in the company kitchen, therefore sterilized as well as rendered perfectly digestible.”

“ The bread (rye brown bread) is mildly laxative, so that constipation is unknown in the Russian army, the bowels being moved freely and abundantly—a matter of importance from the hygienic point of view.”

“ The Russian soldiers' ordinary beverage is tea, a mild infusion of Chinese tea which can be drunk in large amounts without unpleasant effects. The Russian

is not satisfied with hot-water tea ; he always wants it made as it should be, with boiling water, which is easily obtained from the company kitchen boiler. Most of the liquid ingested, therefore, is in a sterilized form, either as tea or soup."

" Serious efforts were made by those in high authority to place the soldier in as good a sanitary condition as possible ; no money was spared to secure comfortable quarters, wholesome food, and a sufficiency of well-equipped hospitals."

" Flies had been accused of being the chief transmitters of typhoid " (*i.e.*, enteric) " infection. In summer they swarmed in the camp. . . . Dust is also abundant. Manchuria is the land of dust."

" In the whole campaign we had a total of over 2,700 cases of enteric," and, adds the Surgeon-General, " it is doubtful if the ratio of enteric cases ever exceeded 5 per 1,000." We may compare this with the 150 per 1,000 which prevailed in the U.S. camp in 1898 ; although, " this fever is not rare amongst the Russian civil population in Manchuria."

Now, gentlemen, I am not going to trouble you with any more statistics. I must, however, say that if we take into account the cases of beri-beri, of which the Japanese had an outbreak, owing to defective food in General Nogi's army in the early part of the war, we must allow that the Russians were the more successful in preventing preventable disease. And if you ponder over the extracts from Surgeon-General Havard's report which I have just read to you, you will see why they succeeded.

I should just like, before I finish, to comment on three points of that report. The first is the use of soup in camp and on the march. The Russians have a portable

soup-cart, and I was very pleased to hear that Lord Kitchener was having this adopted on trial, for use in the army in India. Hard-working men must have liquid in some form or other. It is to be hoped that in all manœuvres in future the rush will be for the soup-cart, and not for the too-often poisoned water-cart.

Again, you must have noticed, as a complete innovation, the use of hot, to say nothing of vapour, baths, at the front. Let me tell you that your transport is burdened with far less useful impedimenta than the materials for hot baths and plenty of soap, would be. Modern surgery has improved so much since Lord Lister's discovery that really I consider that anyone who survives a bullet-wound for twenty-four hours ought to get well altogether. I cannot, at the moment, think of any wound that ought not to recover, if the soldier goes into battle with a clean skin. Give me a clean skin, a well-nourished body, and an empty stomach, and if you survive your wound long enough for the surgeon to do the rest you ought not to die of wounds. The Japanese have an ancient custom of taking a warm bath and putting on their best uniform and clean linen before going into battle. Their idea is not to present an unseemly corpse when they are brought back dead. You should do the same, so that if you are hit in battle the surgeon may get a fair chance. Remember that the whole surface of a dirty body is covered with germs which, if they get through the skin, at once set up a fight with your white corpuscles and create pus. Dirt, too, is the hiding-place of the germs which produce hospital gangrene, which used to play such havoc in the old days. *In fact, you should never forget that dirt and disease and death are bedfellows, and where the first is allowed to rest, the others soon follow.*

My third point is this. I want you, when opportunity occurs, to use your influence to get the hard, indigestible, and very constipating ration biscuit abolished in favour of brown bread, as the Russians have done with such good results.

This, then, gentlemen, is all that I have to say on the subject of Camp and Personal Hygiene, and I hope that my course has not tired out your patience. If it has not—and I am pleased to say that I believe it has not—then I do hope that the course will have done something towards keeping your attention fixed upon health as “the first necessity in all military matters,” as was so well brought out by Lord Nelson more than one hundred years ago, and I hope that the course may help a little towards that reunion of combatant and medical officers of the army which, to my mind, is so much to be desired. When they took away your regimental soldier, to the loss of medical officer and the still greater loss of the regimental soldier, they gave you nothing instead. The medical officer was sent off to his hospital to cure disease, and until lately, at all events, it did not appear to strike anyone that what the army wanted was prevention of sickness, which is always better and easier than cure. If I have succeeded in awaking your interest in the fight with disease, then I would suggest that you follow the progress of that fight by reading of the advances made in preventive medicine from time to time. You do not require to be a physician, or a surgeon, to know all about the means of preventing sickness. Personally, I should like to hear that the *Journal of the Royal Army Medical Corps* was to be found amongst the publications in the ante-room of every regiment. I do not say that you should read all the contributions to this journal—most of the members

of my profession, unfortunately, delight in long words and in writing in a style which it is not intended to be understood—but there are many interesting investigations being carried on by officers of the R.A.M.C. the reports of which I think you ought to see, as you would see if you looked through this journal. Gentlemen, in conclusion, I have only to thank you for your attention, and to express the hope that these lectures will be of use to you in the great task you have in hand—*i.e.*, the keeping of our soldiers' health in the highest condition, so that you and they may be ready for any call which may at any time be made upon them.

LECTURE V

HEALTH AND FITNESS*

Soldiers and the invisible foe, disease—Training—How to fight thirst—Effects of excessive smoking on the heart—Venereal diseases—Precautions to be taken on foreign service—Precautions against tetanus—The prevention of sore feet—Conclusion.

HAVING had the honour of addressing the officers and N.C.O.'s of your regiment recently on the subject of the avoidance of sickness by soldiers during peace and war, it struck me that I could not be considered to have completed my task unless I also had a talk with you men who have recently joined the regiment. The reason I stand before you here to-day and ask you men to give me all your attention for just one half-hour is simply this: I have made a special study of the causes of sickness, which as a medical man is, of course, my first duty, and of training for athletics, which as a sportsman is my great pleasure, and the result of these combined studies is to make me quite certain that any man who knows a few simple truths, of which I propose to inform you to-day, and who will take the trouble to keep himself in training and properly and rationally "fit," ought never to see the inside of a

* Delivered to the recruits of the 3rd Dragoon Guards and the 11th and 19th Hussars in Dublin and at the Curragh.

hospital, except, of course, as the result of an accident or of wounds.

That you, each of you, at the commencement of the career which is, fortunately, before you, should to-day resolve not to neglect any means of keeping fit and well is the resolution which I ask you to agree to now. Men who have passed fit for service ought not, apart from the result of accidents during their military career, ever to see the inside of a military hospital ; and before I give you the very simple and easily remembered hints, which will, I hope and confidently expect, enable every one of you to keep out of hospital, I should like to take this opportunity of congratulating you upon the career you have adopted and the regiment you have joined. Some of you may find the work hard and your duty difficult to master ; but I can tell you that, while work is a condition of happiness in this world, your work is a real pleasure to the man of sporting tastes, and if you compare your work with the drudgery which the vast majority of civilians have to go through, in one shape or another, you will quickly see how fortunate you have been in your choice of a career. You who have joined this regiment, too, are especially to be envied, for, wherever you go, either amongst soldiers or civilians, your full-dress uniform or your shoulder-badges are marks of honour looked up to by all, who will honour you as the representative of the great traditions and honourable history of your regiment. You, indeed, as cavalry soldiers of such a regiment as this, at the commencement of your careers, are indeed to be envied. But as soldiers you must know how to fight, not only the visible foe, should your country again be at war, but the invisible foe—disease. That is the fight I have come to speak to you about to-day. For,

unfortunately, even in times of peace, British soldiers are yearly killed, or rendered unfit for further service, in numbers which to us, who know that all sickness is now preventable, is very melancholy reading indeed. In the old days, even as late as a few years ago, we sympathized with the man who got sick. Now we know that it is his own fault. We know that, had he taken proper care of himself—his first duty—he would not have got sick. You who have just made the resolution that you will not be sick will naturally ask me what I mean, how I propose to help you to avoid it. My answer is by telling you that we now know that all these sicknesses which fill our military hospitals are caused by germs ; that these germs live in and on dirt and in used-up air ; and that fresh air and sunlight and cleanness kill them all. We know now that every man has in his blood a special part of it which kills these microbes if he gives his blood fresh air and exercise, and does not poison it by breathing in air which has been used up in other people's lungs. Therefore, if you would avoid sickness, you must be clean, and see that all is clean around you. Hence you should miss no opportunity of taking baths and keeping your hands and the whole of the surface of your body clean. But, in addition to the outer surface of your body, you have an inner surface—from the mouth to the opening of the bowel—and this surface must be kept clean, too, by means of a daily and regular emptying of its contents. This may seem to you an unnecessary thing to talk about, but let me tell you that it was carelessness and neglect about this matter that caused a large proportion of the deaths from enteric in South Africa during the late war. The men drank filthy water, and then got up too late and were too lazy to give Nature

the chance she craved for before marching. Hence the germs multiplied inside, and the soldier sickened and often died, and was buried where he died. Next to keeping the surface clean, there is nothing so important as seeing that you put nothing dirty into the mouth. You need not worry on the score of food. That is all provided and prepared for you. But on the subject of drink I must say something. Water is the great means by which the germs which cause enteric and dysentery are carried about. Now, should your regiment go to war, if you behave as British soldiers have always behaved in the past, a large number of you will die of these diseases—about four of you will die in this unnecessary way for one who is killed in action. If you take my advice, not one of you will die of enteric or dysentery. To avoid that, all I want you to do is to fight the first sensations of thirst. You will find, if you do that, your thirst will cease. Just try this when you are doing your training for athletics, or on the manœuvres this year, and see if it is not so. Fight your thirst until you can get into camp, and then have some tea. Tea means boiled water, and no disease-causing germ can be boiled and live. Boiling kills them all. If you can't get anything to boil the water with, then eat some food with the water. The gastric and intestinal juices, which eating causes to flow, will kill these germs unless the water is very full of them indeed. Don't, above all things, drink between meals, either at home or on foreign service. This leads me to say something to you about alcohol. Now this is a subject about which I don't want you to think that you are being talked to by a faddist. I would like to tell you, by all means have your glass of beer if you really like it, but it is my duty to tell you that if you decide to do with-

out stimulants altogether you will be better men—better developed, better at games, and better in a fight, if it should come to one. There is now no room to doubt—we have proved it scientifically—that man is better without alcohol ; that it is actually harmful if taken between meals, because it upsets digestion ; and that it should be altogether avoided by men who are in training. You, as soldiers, have, of course, agreed to keep as fit as it is possible for men to be made ; indeed, keeping yourselves in health is your side of the contract you have made with His Majesty the King.

Now the question of fitness immediately leads me to say something to you on the subject of smoking. Here, again, I do not want you to think that you are being talked to by a faddist. By all means, if you really like smoking, smoke, but do so in moderation, and don't buy the cheapest American cigarettes you can get. Buy good ones. At the same time, smoking is a mistake if you want to excel in your favourite form of athletics, or if you want to be fit enough thoroughly to enjoy a soldier's life, and be a credit to your regiment in any sort of contest. What a mistake it is for young men to smoke excessively was never so impressed upon me as it has been during the last few years, when it has been my duty to examine medically the recruits for the Yeomanry. I have been astonished at the numbers of men under twenty-one years whom I have had to speak to, or even actually to reject, as unfit for service because they were suffering from what we call "disordered action of the heart." Tobacco is a depressant and an irritant to the muscle of the heart, and disordered action of the heart, if long continued, I am sorry to tell you, leads to actual disease. In several cases where men were really keen to join the

Yeomanry I have refused to pass them while so suffering, but told the would-be recruit to stop, or greatly reduce, his excessive smoking, and come back to me in six months. In many cases they have done so, and come back not only cured of their irritable hearts, but they have thanked me for the advice, and said that they never felt so well as they had done since they gave up smoking, although some of them have told me that the struggle was at first very severe, but that they have since learned that smoking was only a habit. Now I suggest to you men that you should try if it is only a habit with you, and if you find that it is after all only a habit, then look at all the money you will save which now you spend upon something which you are better without. Personally, I remember, when I was the age that most of you men are now, and even younger, that I used to smoke a great deal because I thought it was the right thing to do. I gave it up while in training for athletics, and although I occasionally like a smoke again, I have never let it become a habit, and I advise you men, while you are soldiers, not to let smoking become a habit with you either. It only interferes with your training, and spends your money, and does you no good.

The word "training" reminds me to say something about your gymnastic exercises. There is nothing more interesting for a doctor than to examine the heart of a young athlete before he has undergone his course of gymnastics, and again to note the increased force and steadiness of the beats after he has spent some time in the gymnasium. It is interesting to note, however, that it is the man who goes into the gymnasium with the idea of thoroughly enjoying himself while there who gains the greatest benefit from his course of train-

ing. Now, you cavalry soldiers are particularly fortunate about gymnastic exercises. For there never was an exercise invented which is calculated to do a man so much good as is grooming a horse. This is an ideal exercise if carried out in well-ventilated stalls. Therefore, I ask you men to go at this exercise every day with the idea not only that you are doing good to your best friend, your horse, but also to go at it as a labour of love, with the idea that it will help you to develop and lay up a store of health and strength which will last you for the remainder of your life. Do it well, and you will enjoy it. Enjoy anything, and you gain health from it.

Now, if you avoid drinking and smoking, except in the greatest moderation ; if you keep the surfaces of your body clean inside and outside ; and if you live in clean surroundings and breathe in pure air, then I say that you ought to avoid all the diseases which soldiers are liable to.

There is one class of disease which I want to speak to you upon specially. That is venereal disease, the diseases which men get from women, and which have their birth and existence in the dirty condition in which women of the town keep their bodies. The amount of loss suffered by the British Army from these diseases is appalling, and we know that they are preventable, and have been prevented to a great extent in the armies of the Continent. There are two severe forms of these diseases—syphilis and gonorrhœa.

[Here the lecturer practically repeated the directions given on pp. 35-39, and finished by a special address to the drafts which were about to proceed to India, in which he said :]

I wish to say a special word to those of you here present who are about to sail for India. You all,

of course, want to enjoy your tour while you are there, and to come home again. To do this you will have to take certain precautions, and if you do take these precautions you will find that life in India is very pleasant indeed, and that the climate is not the very unhealthy one it is so often painted. Indeed, we know now that there is no such thing as an unhealthy climate, apart from the disease-causing germs, which, of course, flourish more in hot, damp climates than they do at home. But if you can keep these germs away from you, if proper precautions are taken to protect your body from the extremes of heat and cold, and if you avoid destroying any part of your body, such as your liver, by taking alcohol, which is poison in hot climates, you will find that what I say is true—the climate has nothing unhealthy about it. I want you who are about to sail just to oblige me—I want to hear that you have had no sickness amongst you—by reading carefully Lecture III. in “War with Disease.” Then, having read it, resolve that you will take your part in the fight with disease, and not go down before a wretched little microbe. Resolve, when you are parting with your friends, that you will come home again fit and well. I hope you won’t get tired, and accuse me of repeating myself when I again impress upon you that to keep out of hospital and to come home again you must keep clean, and see that all is clean around you. Above all, I ask you to join in the fight against the dirty way in which the latrines are kept in too many stations in India. Don’t forget the advice I give in Lecture IV., which I also want you to read. Don’t drink anything bought at bazaars, and don’t forget that ice-creams and “milk shakes ” often contain millions of germs. Freezing does

not kill germs, although, fortunately for us, boiling does.

Lastly, about the permanganate of potash, which I have urged you to use under certain dangerous circumstances, I want you to carry it about with you in India, and always immediately wash any cut or wound you may get with it. Tetanus—the common name of which is “lock-jaw”—is, I am sorry to say, getting more common in India than it used to be. The germ which causes this disease lives in clay. If any of you get wounded by anything which has been on the clay, a comrade should immediately suck the wound for him, if it is in a position which he cannot suck himself, and then the wound should be thoroughly washed with a strong solution of permanganate of potash. A man who is ready to do this for a comrade on the spot in all probability has saved the life of a soldier of the King—saved him from a most painful illness and death; and with regard to permanganate of potash, too, if you are beginning to suffer from foot-soreness—and most soldiers, even cavalry soldiers, suffer from sore feet during some part of their marching in hot climates—a good wash with permanganate of potash in water is the very best thing you can have to cure the soreness and harden the feet.

I thank you all for having listened to me with so much attention, and now I have only to add that if anyone has any questions I shall be only too delighted to listen to him and answer the point raised. If you all act as carefully as you have listened, then I shall have gained my end, which is to hear that none of you have been sick during the period of your service with this regiment. Always remember that the training which you are now receiving, and which is making you

into soldiers, is costing your country a great deal of money; show your gratitude by making yourselves into soldiers worthy of the name. When all comes to all, a nation possesses nothing except what her trained soldiers can hold for her. Soldiers who fall unnecessarily sick in war, from being the most valuable of men, become the least valuable, and even a burthen on their country, at the very time when she needs all her energies to face the foe in front. Sickness, I repeat, is caused by ignorance and carelessness, and ought to be avoided by all men who are worthy to be called soldiers. I am sure that when you know this you will decide to take your part in war with disease not only for your own sake, but also for the sake of your comrades and friends, and, above all, for the credit of the regiment.

PART II

INTRODUCTION TO THE WORK OF
AN AMBULANCE SECTION

LECTURE I

INTRODUCTORY LECTURE ON THE WORK OF AN AMBULANCE SECTION

What a soldier undertakes when he enlists—Preventible diseases
—The duty of rendering first aid—Cases in which stimulants
should not be given—Ambulance work not to interfere with
training of soldiers.

THE subject which I have the honour of bringing under your notice in the course which the Ambulance Section commences to-day is one which cannot, I think, fail to interest every member of the regiment.

Although nominally the object of these lectures is to enable you to render First Aid to each other under any circumstances of accident, sudden illness, or wound, yet to enable you to do this with intelligence, and to enable you to convey intelligent information of what is wrong to your officers, it is necessary that you should first of all know something of the body which you may at any moment be called upon to treat. To know something of the structure and functions of the human body is to know something of yourselves. Before, then, I attempt to teach those of you who intend to join my class how to assist a comrade who needs your assistance, I propose to teach the essentials of anatomy—which is only the structure of your own bodies—and a little of the essentials of physiology, which teaches you how that body of yours does its work. Such a subject can-

not, I think, fail to interest any intelligent being, and the information you learn cannot fail, I believe, to be of use to you in the preservation of your own and of your comrades' health. For, although the objects of this class, as laid down by King's Regulations, are to enable you to render First Aid and carry wounded men properly, and although that is a great and worthy object, yet I want the ambulance section of this regiment to be of more use than that. I want the Ambulance Section to act as a centre from which wisdom on the subject of the preservation of health shall flow in all directions, even to the latest joined recruit. Let me explain to you fully what I mean. I contend that all sickness has a cause, and can be prevented, and that most of the sickness we see amongst soldiers is very easily prevented indeed, and is caused by mistakes made by the individual. A soldier, when he joins His Majesty's army, undertakes to do all in his power to keep himself in training and fit to serve his country when called upon. Now, what I want in these lectures to make clear to you—so that you may, for the honour and credit of your regiment, pass the information on to your comrades—is this: that if you really do keep yourselves in training—and I propose to tell you how you should do this—you will avoid all of the many sicknesses of both home and foreign service which annually cost our country dear by the loss of many of her trained soldiers, who are really the most valuable possession of a great nation.

A few facts taken from the past will, I hope, help to make you see the importance of what I have to say to you. Of the vast army which we sent to South Africa in the recent war, only thirty-four men in every 1,000 found their way into hospital from wounds, while no

less than 746 men per 1,000 found themselves in hospital from disease during some part of their service there. In the first winter of the Crimean War, of the gallant army sent there to fight the Russians, just one man in every three was dead of disease in the first six months ! One in three dead is an appalling figure, but the men, eager to fight, being utterly ignorant of any sanitary laws, simply poisoned each other in their camping-grounds and trenches. A Sanitary Commission, consisting of two doctors and one engineer, was sent out when the country rose in horror at the slaughter of her soldiers. This Commission had power to give orders and enforce them, with the result that, in the second winter, with an army of just over 50,000 men in the field, we only lost 551 men in deaths from sickness ! In other words, in our last year in the Crimea, even after the appalling start, the sanitation of our army was better than it was in our first year in South Africa ! We had forgotten the necessity of sanitation until the horror of the "halt at Bloemfontein" reminded us that Nature is the only force no army can fight. The importance of the lesson for us is this: that, should a big war break out, a service section of the South of Ireland Yeomanry will be, I hope, amongst the first to volunteer to take the field. Then, if in the general confusion and mismanagement of the early months of war you know the sanitary laws and obey them—and they are simple common-sense, and nothing more—your comrades will be able to keep in the field up to full strength, as far as losses by sickness are concerned, and you will be able to avoid for yourselves and comrades that most melancholy of all announcements in the *Gazette*, "Died of disease."

Sickness is war's greatest danger, and the sickness

of armies in the field is preventable, and nearly all caused either by slackness or ignorance, or both, on the part of officers and men.

[Here the lecturer went fully into the question of the prevention of enteric and dysentery, as reported on pp. 8-17 in Lecture I., and read Surgeon-General Havard's report (p. 78) to show how enteric was prevented in the Russian army; and then continued as follows :]

But enteric and dysentery, great decimators of armies as they are, are not the only diseases which in this course I intend to show you how to avoid. Tuberculosis in all its forms, slayer of millions annually as it is, is to my mind a preventable disease, and easily prevented. Malaria—that arch-curse of foreign service—is now a preventable disease. All venereal diseases are preventable, and ought to be avoided. Diseases predisposed to by chill are for the most part preventable, and if you empty our military hospitals of their cases of enteric fever, dysentery, venereal diseases, malaria, tubercular diseases, and the diseases due to chill, how many efficient soldiers would you not add to the strength of His Majesty's army! Emphatically I say that it can be done, and I propose to show you how to do it; and if you take my advice—and my advice is easily taken—you will have practically no sickness in your regiment, just as some well-ordered regiments manage to get on with practically no crime.

Those diseases which I have mentioned, although they still fill our military hospitals, and cost us millions in war-time, are, to my mind, just as preventable as are those scourges of white armies in the past—*i.e.*, plague, cholera, small-pox, typhus, scurvy, and ophthalmia. But what awful scourges these diseases used to be, you will get some idea of when I tell you

that after Napoleon's retreat from Moscow over 40,000 soldiers died round Paris in six weeks of typhus fever ; while in the Franco-German War 23,000 men died of an epidemic of small-pox which was introduced by a few recruits from Breton. And here we get the strongest argument ever given us in favour of vaccination. The German army were pursuing the French ; they were taking them prisoners, and taking charge of their sick, and occupying the infected camping-grounds ; but they were vaccinated, and they only lost in the whole campaign 226 from small-pox. The French army corps, which was decimated, was for the most part unvaccinated.

All effective preventive measures consist of simple precautions, which I shall tell you about ; and as I shall always give you the reason for any statement which I shall make, I hope by this means that you will be all able to remember the points I bring under your notice. One point I want to make absolutely clear. This is not to be a stiff and starch course of lectures. I want anyone who does not follow anything that I am saying to question me about it. I intend before we part company to question you pretty fully, and I noticed in a former class that those members of the class who asked me most questions were the very men who gave me the best answers as we got on with the course and grew to know one another better. Do not be afraid that I may think any question is stupid or unnecessary. I know that this subject is absolutely new to you, and my only fear is that I shall go too fast for you. Remember that I shall have failed altogether if I do not teach my subject to you well enough to enable you to pass on the information to others. When you have passed your examination for " Certifi-

cates of Proficiency," you will be entitled to wear a badge on the left arm. This badge will not, as cavalry soldiers, take you out of the ranks, either in peace or in war ; but it will, I hope, be a sign to your comrades that they may rely upon your assistance if they meet with an accident, and your advice as to what precautions they should take to preserve their health under the various trials and circumstances in which the regiment may find itself. It is not at all to the credit of the regiment that you should have a large proportion of men "going sick," and I propose to show you how you may prevent this. This is, to my mind, the greatest work of an Ambulance Section.

To-day, however, we shall begin with the subject of First Aid. In order to make this subject as interesting as I can—for I myself must confess that I have found books on First Aid intolerably dry, and hence difficult for the ordinary reader to follow or remember—I propose to ask you to imagine yourself in the position of a person who is called upon to render First Aid to a comrade, a stranger, or even an enemy. Let us assume now that each one of you finds himself in that position at the present moment. What is his duty ? In the absence of a military necessity, which only exists in a state of war, and which obliges you to go on without regard to individuals or their sufferings, it is the duty of every man who meets a human being in distress to render him First Aid. Before we come to an individual case, let us be clear what is the object of First Aid. Its objects are threefold, its limitations are the same ; and if you always bear the objects and limitations in mind, you will avoid all the mistakes that are but too often made by the over-officious renderer of First Aid. Its objects are :

1. To preserve life, as in cases of hæmorrhage and drowning.
2. To prevent aggravation of injuries pending the placing of the case under medical charge.
3. To relieve pain and to prevent all unnecessary pain.

Bearing these objects in mind, let us now assume that you have come upon a man lying senseless upon the wayside. You do not know what has happened. What do you do? At once and without hesitation you go up to the man, place him on his back in as comfortable a position as possible, and open anything about the neck that might interfere with the free ingress of air. Then go to the other end of his chest, and see that nothing, such as tight belts or trouser buttons, interfere with the free action of the diaphragm, the great muscle of respiration which acts by contracting downwards on the abdominal cavity. Having made the breathing free, your next duty is to find out what is wrong. What is the cause of your patient being where he is? If he can speak, you ask him, but probably he is senseless, and you have to find out for yourself. While you are doing this—and I propose to take you through all the likely things that may be wrong with your patient—it is your duty to consider the important subject of the administration of stimulants. If there are any bystanders near you, they will not wait long in suggesting whisky or brandy; and it is your duty, if you are taking charge of the case, to decide if it is one suitable for stimulants or not. This decision is very easily arrived at if you remember a few “don’ts,” which I hope to help you to remember by giving the reasons for them. They are:

1. Don’t give stimulants in cases of hæmorrhage, the

reason for this being that fainting is Nature's way of stopping bleeding; and if you give stimulants you set the heart going again, and restart the hæmorrhage.

2. Don't give stimulants in cases of head injuries. The reason for this is that stimulants go at once to the head, and increase the inflammation which is a sequel to such injuries. It will help you to remember this if I remind you of the "head" which but too often follows "a spree." Well, a "head" follows a head injury as well, and if you give your patient a stimulant you give him agony from the alcohol acting on the inflamed brain. This mistake is often made by people "who must do something." It defeats the third object of First Aid by causing unnecessary pain.
3. Don't give stimulants when you don't know what is wrong. This "don't" will save you from the humiliating mistake of giving stimulants to a drunken man, as has often been done, or from giving stimulants to cases of apoplexy, or internal hæmorrhage of any sort.
4. Don't give stimulants to an insensible person. To do so is dangerous, as the liquid may run down "the wrong way," and cause much subsequent pain and coughing.

If, however, a patient is lying pale and cold and insensible, it is the right thing to rub whisky or brandy with the finger around the inside of the mouth.

Now, I have given you some "don'ts." Let me summarize the cases in which you *may* give stimulants. Shortly put, you can give stimulants in all cases of pain,

in all cases where the patient looks pale, and in all cases where the patient is shivering with cold.

To put these two great divisions in another way, so as to help you to remember, I would say let *red*, either red in the face or the red of blood, be your warning note *not* to give stimulants ; let pain and pallor be the indication *to give* them. Or, in a word, with alliteration to help you to remember it—red, refrain ; pain and paleness, pour out your stimulant. As to amount, people generally give too much. A very small half-glass of whisky or brandy in water is ample, and will at once help your patient to bear his pain much better.

Now that we have decided the important question of the administration of stimulants, and settled that, no matter what is wrong, you put your patient into a comfortable position and make his breathing free, and then, if there is anything apparently serious, you send for medical assistance, I should like to adjourn, as before I undertake to teach you what you must do in the case of different injuries pending the arrival of medical assistance, I should like to give you the lecture on Anatomy, as, when you know something of this, you will find it much easier and more interesting, I hope, to follow the different directions which I shall give you.

This concludes my introductory remarks, which I greatly fear I have made longer than I had intended. My excuse for the length of this lecture is that I wanted to say just enough to interest the members of the regiment generally, so that some more than the twenty-eight whom I have already got may join and attend the lectures and drills of the Ambulance Section. This Section cannot be too large, and remember that by joining it you are not taken in any way out of the firing-

line, except in the case of an accident or casualty, when, of course, the nearest ambulance men are expected to do all they can to assist me, or even to deal with the case altogether in the event of my being elsewhere on the field. I will not say absent altogether, because where the regiment goes I go. Remember, also, as last year's class will tell you, that with the exception of the day of the General's inspection, I have never asked the Ambulance Section to turn out for any drill when the regiment is out training, so that in no way will your ambulance work interfere with your training as soldiers ; but I hope and fully expect that you will all find the training which I give you in the first place useful in case of accidents, and doubly useful in preventing disease, and therefore in saving the lives of your fellow-men.

LECTURE II

Anatomy—How muscles do their work—Treatment of fracture of the skull—How to distinguish between fractures and dislocations—Treatment of fractures—Danger of compound fractures—The muscles of the upper extremities—Treatment of fracture of the collar-bone—Muscles of the lower extremity—Comparative study of the bones of man and other animals—Conclusion.

TO-DAY the subject of our lecture is man—the human body, what it is made of, and how it works. In itself it is an intensely interesting subject, but it can be made the more so if we remember that all animals are built on the same model. Here is a diagram of the human skeleton, beside it a skeleton of our friend the horse, to the cavalry soldier almost a part of himself. As we go on and give names to these bones in the human body I shall show you that the very same bones, differently developed to suit the formation of the animal, are to be found in the horse—are, indeed, to be found in all animals.

Let us first of all consider our own bodies. What do they consist of? What does any animal's body consist of? I am sure that if I asked that question round I should get much the same answer, and I should be told that a body consists of bones and flesh, or bones, flesh, and blood. The answer would be correct, but I should like to insist upon a further subdivision of the flesh, and tell you that it consists of two parts—fat, and the red parts, or “lean meat,” which I must ask you in future to call *muscle*. Muscle consists of bundles of reddish

elastic fibre which have the power of contraction under stimulation. This stimulation is brought to them from the brain by means of nerves, and it is the contraction of these muscles which enables you to perform every movement made by your bodies. Striped muscles are attached to at least two bones, and when they contract—that is, become shorter—movements are made at the joints. Take as an example the biceps muscle in the upper arm. It is attached by two heads to the shoulder-blade up here, and it is then, by means of its tendon, fixed on to this bone, the radius. When it contracts it pulls the forearm up in this way, and to get it straight again we have to use a muscle to oppose it, and this we have in the triceps at the back of the arm. That is the way muscles enable you to do all you want to do in health. Your brain sends the message through the nerves which are distributed all over the body to every muscle, as is well seen in the diagram I now show you ; but when a bone is broken it is easy for you to imagine how the muscles, now upset in their action, will pull bones out of their places, and how much you need to control them by the means which I shall show you. We must first of all, however, learn something of bones in health. The human body consists of exactly 200 bones. Don't, however, be alarmed at the number ; I shall very quickly indeed reduce those I want you to know something more than the name of to a very small number. I show you here one of the vertebræ, twenty-six of which compose the spine, all having the same character. Each vertebra consists of a solid part or body in front and an arch behind, which arch makes a canal for the spinal cord to pass through. This brings us to the first great use of our bones—*i.e.*, to protect structures of vital importance, such as the spinal cord,

which passes along this canal ; and the brain, which is contained in the cavity of the cranium, formed by eight bones ; and the chest, formed by twelve ribs on each side with this bone, called the sternum in front, and the dorsal vertebræ behind. When I add that the face is composed of fourteen bones all, except the lower jaw, fused into one, and that with that exception I shall have no more to say to you about these bones, except to show them to you on the human skull here, you will see that I have already disposed of no less than seventy-four of our 200 bones. Now I show you here a hand consisting of no less than twenty-seven bones, so that in both hands you dispose of fifty-four bones. Here, again, I show you a foot, consisting of twenty-six bones, so that the two feet dispose of another fifty-two bones for us. With these bones—unless, as a matter of interest, you want to see what they are like—I shall not trouble you again. This leaves us with only twenty out of 200 to which I shall have to ask you to give attention, and as these twenty are on each side, the bones I want you really to know something about are reduced to ten. These ten are : the clavicle, scapula, humerus, radius, ulna, in the upper ; the os innominatum, femur, patella, tibia, fibula, in the lower. To these I now add the skull and face as one bone, as it appears here to you, and the lower jaw, of which I shall also have to speak, so that altogether twelve bones are all that I shall ask you to become familiar with.

Now let us study these under three heads :

1. Their position and use in health.
2. Their fractures.
3. The joints formed by them in health and dislocation.

To begin with the skull. It contains and protects the great organ of life, the brain itself. In this brain—the most wonderful of all things in nature—all your thoughts and actions originate, all your pleasures and pains are appreciated. Cut off the brain, or cut off the blood-supply to the brain, and nothing else matters; you may do what you like to the body, no pain is felt. At present I will not say more to you than that it is composed of nervous tissue, and that different parts of it preside over different movements and thoughts. Now we must give our attention to the skull, which protects this wonderful organ. It is subject to two types of fracture—*fractures of the vault* up here, and *fractures of the base*. For you the treatment is the same as for all serious injuries of the head—*i.e.*, get the patient at rest in a comfortable position, and arrange to have him removed with the least possible shaking to the hospital. If you are putting him on a stretcher in the manner which I shall show you when we come to our stretcher-drill, take care not to shake the head in the very smallest degree, and give nothing in the way of stimulants or, indeed, anything else.

From the head we pass on to the lower jaw, the only movable bone in the skull. It, like the ten bones of which I have yet to speak to you, is subject to (1) fracture, (2) dislocation. The treatment is different, so that you will have to learn how to distinguish between a fracture and a dislocation. I give you a list of six points of difference, which apply to all fractures and dislocations, no matter what the bone is. You should remember these points, as they are frequent questions in examinations for First Aid certificates; but while I want you to remember them, I want you in practice, if you are in any doubt at all, to

treat any doubtful case as one of fracture, and protect the injured part by means of splints.

The following, then, are the signs of dislocation as contrasted with those of fracture :

In Dislocation we get—

1. *Pain* in and around the joint.

2. *Change in the shape* of the joint and in the relation of the bony prominences to one another.

3. The *articular end* of the displaced bone *may* be felt in a new position.

4. *Impaired motion*.

5. Alteration in the length of the limb—*i.e.*, *lengthening*.

6. Alteration of the direction of its axis.

In Fracture we get—

1. Pain, but around the seat of fracture.

2. Change in shape, but in the limb.

3. *Crepitus* may be felt.

4. *Increased mobility* in the continuity of the bone.

5. *Shortening*, with displacement.

6. Alterations of position of fragments caused by muscular actions.

With regard to No. 3, if this sign is obtained it is, of course, conclusive, or as surgeons call it “ diagnostic ” of the condition. Renderers of First Aid should not, however, attempt to get crepitus, and it should never be forgotten that a bone may be both broken and dislocated.

As to the treatment, the first point that should be always remembered is that we must not cause any unnecessary pain, and therefore must not pull the injured limb about unless we see clearly what we are doing, and what is the object we have in view. Now, if you find that the limb is dislocated, you must not make any attempt to reduce the dislocation, and your treatment simply consists in putting the limb at rest in a comfortable position, and sending for the surgeon, or having the patient

taken to him. With regard to fractures, the treatment is exactly the opposite. A broken limb, with its extra mobility, is never safe from suffering further damage until it has been set and put up in splints. If the lower limb is broken it must be set before you dare to run the risk of moving the patient, or even of putting him on a stretcher; and fractures of the upper limb are best set as soon as possible, but it is usual and most convenient simply to put them up in a sling, and wait for the surgeon to set them.

Before you attempt to set any fracture you must get your splints, and have them ready by your side. First Aid splints are made from pieces of board, walking-sticks, thick newspapers, or anything that will result in giving the fixity you require to the limb.

If you are where you cannot get a surgeon for twenty-four hours or more, and are, therefore, setting the limb, not with a view to its being again put up in splints by the surgeon, but with a view to its remaining as you have set it, you must remember the following points, and arrange your splints accordingly :

1. The splint must be wider than the limb.
2. It must embrace and securely fix the two joints connected with the fractured bone.
3. It must be well padded beyond the edges.
4. Never put a bandage under the splint.

Now as to the actual operation of setting the bone. It is done by the firm but gentle extension of the limb with one hand, while with the other the broken ends of the bone are manipulated back into their places, and as soon as the natural shape of the limb is restored splints should be applied to retain the parts in posi-

tion. Remember to be very careful to keep up the extension of the limb until the splints have been applied and fixed by their bandages, otherwise the action of the muscles will pull the broken ends of the bones out of their places, and so undo all your work.

Remember, too, that the great dangers you have to fight against are (1) the injury of other structures, such as bloodvessels, by the sharp ends of the broken bone, when the fracture becomes what we call "complicated"; or (2) the protrusion of the ends of the bone through the skin when the fracture becomes "compound"—a very serious condition indeed, for a patient with a compound fracture is in grave danger of losing either life or limb. Why a compound fracture—that is, one in which the air communicates with the wound of the bone—is so incomparably more serious a matter for the patient you will fully understand when I come to tell you a little of bacteriology, as I must do in our lecture on Health. Now I need only say that guarding against converting a simple fracture, which only takes time to get well, into a compound fracture, which is always dangerous to life, is the first and the greatest object of the First Aid treatment of such injuries. It is for this reason that in cases of fracture or of suspected fracture you should always cut off any boots or clothes that give difficulty in their removal. When life, or even the giving of extra pain, is in question you must not hesitate to cut, or rather rip, even the newest and most gorgeous uniform. The right thing is to rip clothes at the seams, and so take them off without any pulling at the seat of injury. Of course, in setting fractures temporarily out of doors you apply the splints over the clothes. You remove the boot, as the foot often swells badly, and in doing this cut freely if neces-

sary. In the hunting-field a few years ago a gentleman fell and broke his leg—an ordinary fracture of both bones, which would have got perfectly well only that, to save his top-boots, they were pulled off instead of being cut, as they should have been. He nearly died of the suppuration in consequence, and he has not used those boots since, nor will he ever again, as his constitution was undermined by the prolonged suppuration, although, as I told you, the fracture, if properly treated, would have been nothing, and he should have been all right in about two months. This will impress upon you the danger of converting a simple into a compound fracture. Before I show you how to apply the different manipulations for setting the fractures of the bones I have already mentioned, I should like to teach you something of the actions and positions of the various muscles which you find so useful in health, but whose disorganized action you have to contend against when the bones are broken. Before that, however, I want you to spend some time in becoming familiar with the names and appearances of the bones which I have here before me. Take them in your hands, and place them on your limbs, as they are in your own bodies. Let me pass them round, and see that you know enough of their shapes and formations to place them at the side of your body to which they belong. We must spend some time at this exercise, as next we must be able to cover these bones with the muscles and the other structures which go to make up a human body.

Here we have the human skeleton as a whole. Here we have the separate bones. Let us put them together, and dress these dry bones in flesh; put their muscles on them as they are in every one of your bodies, for in

anatomy all men are built on exactly the same plan. To do this I take the bones of the upper limb ; I place them as they are in our bodies, and with this living subject, whose muscles have been well developed in our gymnasium, I build upon these bones the muscles which we all have, and which all have their separate action. I told you that the muscles consist of bundles of reddish fibres which contract, and in doing so get hard at will. But here in this living subject you see the white skin, and something soft beneath it, before I come down on the hard mass of contracted muscle. You can all see and feel the same in every part of your own bodies. The structure which you see is what we call the skin ; it covers and protects the body. Nerves of sensation are spread all over it, which teaches you, by the pain they cause, to take care to protect all parts of the body from violence or injury. The skin takes rank with the kidneys, bowels, and lungs as great excretory organs ; that is to say, it gets rid of matter which is of no further use, and which, if retained, would poison the body. From knowing this function of the skin we learn a lesson in Hygiene. The skin is covered with pores, which must be kept open by scrupulous cleanliness. The custom of the daily bath has added much to the average length of modern life.

The tissue under the skin consists for the most part of a layer of fat, which serves to protect and to retain the heat of the body, and is also a reserve ration, which is consumed if at any time we call for a greater amount of force from the body than can be obtained from the food of our daily meals. Under this layer we come to the muscles, and these I wish you to study. Take here, to begin with, the deltoid muscle ; study its origin in the hardened and contracted muscle at the clavicle here in

front, and the scapula here behind. Look at the place on the dry bones. Trace it down over the shoulder-joint to its insertion on the side of the humerus to what we anatomists call the deltoid ridge. Here is the ridge upon this bone. Now think what happens when this muscle contracts. The whole arm must rise up and stand out straight from the sides in this way. But what happens if the arm gets broken? Look at the bones I have here, and always bear in mind when considering a fracture that when a break takes place in a bone the muscles and nerves round about are irritated so that the former contract and pull on the fragments. Now look at what the deltoid does. If the fracture is up here above its insertion, it pulls the lower fragment upwards and outwards; if, on the other hand, it is below its insertion, it pulls the upper fragment upwards and outwards. This action you have to counteract when you are setting the fracture, and keep counteracted by your splints; that is their use. Of course, the deltoid muscle is only one muscle. Look at this big muscle in front of the chest. It is called the pectoralis major, and it, with a smaller muscle underneath it, is inserted here, and pulls the humerus inwards and forwards. The muscle which opposes it here all down the back is called the latissimus dorsi. I have already told you of the biceps here, and the triceps, and when I add the trapezius, which pulls the shoulder and scapula upwards and backwards, I shall have mentioned all the muscles I intend to trouble you with just now, except those of the forearm, which I shall describe as consisting of the group of flexors in the front of the arm, the group of extensors which oppose them at the back, the supinators on the outer or thumb side of the forearm which bring the hand into this position, and

the pronator radii teres, which, with the small pronator quadratus down here, does the opposite—*i.e.*, pronates the radius. I do not intend to trouble you with learning the origins and insertions of these muscles. I ask you to look at them and learn them from the diagrams. Learn from the diagrams to transpose them into your own bodies ; then learn their actions. To this I want you to give me some little attention, for if you know their actions—know what the muscles are wanted to do, then you will find in every case that the muscles are in the very best possible place to carry out this action, and your own common-sense will tell you where their origin is and where they are inserted. From this general principle you can make a very good guess at the origins and insertions of the various muscles if you are asked the question in an examination ; and much as I should like to go into the subject, we have “so little done, so much to do,” in this short course, that I do not intend to take up your time with it. Common-sense alone, however, would not tell you that the biceps is inserted here into the radius or outer bone of the forearm, while the triceps is inserted here into what is called the olecranon process of the ulna. These points are, as you can at once see, of great importance when we have to deal with a fracture of either of these bones, the action of a biceps in pulling up the upper fragment of a broken radius being one of the forces you have got to control, while in fracture of the olecranon process, which often happens from a heavy fall on the point of the elbow, the triceps sometimes pulls the upper fragment right up into the upper arm. Let me here give you the principle for setting all fractures of the arm. You apply gentle extension in the direction calculated to overcome the resistance of the opposing muscles ;

you then manipulate the ends of the fragments so as to bring them together ; you fix with splints, and always put up in the bent and semiprone position, except in the case of fracture of the olecranon process, when, as common-sense will tell you, you put up with the arm extended, so as to bring the parts together, and you take care that your bandage is so placed as to keep the upper fragment down, touching the lower.

These general directions, however, will not do for a fracture of the clavicle, which of all fractures is the most common one. Look at the bone here, and place it as it is in the living subject. Here I must give you one more muscle to learn by name—that is, this one, the sterno-mastoid, or, as it is sometimes called, the sterno-cleido-mastoid, from the fact that it has a sternal and a clavicular origin, and is inserted here into the mastoid process of the temporal bone. This muscle is of double importance to us—of importance to us in our work of to-day, because it pulls the inner fragment of the broken clavicle upwards when that bone is broken ; and in the next lecture, when we come to deal with the great bloodvessels, you will see that it is an important landmark. To-day, however, this muscle gives us the hint as to how to treat a fractured clavicle. You cannot put it out of action. If the bone is broken, it will pull at it. Therefore we take the hint, and do the next best thing we can—that is, we raise the outer fragment up to the level of it. This we do by putting a pad in the axilla here and applying a bandage and sling in the manner which I shall show you and ask you to do in our lecture on Bandaging. As in all fractures, you must be most careful to avoid any unnecessary pain, and if a surgeon's services are available it is much more satisfactory from all points of view for you only to put the arm in a sling

in the best position, and send for, or have the patient conveyed to, the surgeon. It is, of course, impossible for you in this course, nor is it expected that you should, learn all anatomy; and to show you that our summary of the muscles does not contain all the information which might be of use to you had we time to go through it, I show you here a diagram of the hand and wrist which will demonstrate to you a very pretty complication of muscles and tendons.

Passing from the upper to the lower, I am glad to say that the group of muscles in the lower are so simple that it will not even be necessary to demonstrate them on the living subject. This diagram and your own bodies are quite enough. In the front of the thigh we have this big muscle called the quadriceps extensor. It really consists of four muscles fused together. It is inserted through the patella and ligamentum patellæ into the tibia or inner and larger of the two bones of the leg. This muscle is used to extend the leg upon the thigh. It is, of course, the muscle we use first and most in walking and kicking. Crossing over it we have the sartorius muscle, which is the longest muscle in the body. It also is inserted into the tibia. It flexes the leg upon the thigh and the thigh upon the pelvis, and it rotates the thigh inwards. Coming to the inside of the thigh, we have the great group of the adductors, which are the muscles by the contraction of which you grip on to your horse. The diagram shows them well, and a great powerful group they are when we learn how to use them. In the back of the thigh the first and most remarkable muscles we meet are the muscles of the gluteal region. These muscles are a human characteristic in their great development, and they serve to maintain the body in an erect position. They

are developed to an extraordinary extent amongst the Hottentots, a people who have the biggest gluteal regions on the face of the globe. Without contracting them, you could not stand up. Below these are the flexors of the thigh, of which the outer and single one is called the biceps of the thigh, its long head being inserted into the fibula, while its short head is inserted into this ridge on the femur. These muscles act as their name implies—*i.e.*, they flex the leg at the knee-joint. Coming now to the leg proper, we have the tibialis anticus here in front and next to the tibia. This muscle inserted here at the base of the great toe raises the inner border of the foot, and thus helps to flex the tarsus, or foot, upon the leg. The other muscles in the front of the leg are the extensors of the toes and a small muscle called the peroneus tertius, which flexes the outer side of the tarsus. At the back of the leg we have the gastrocnemius and the soleus, which are inserted through the tendo Achillis into the os calcis, or heel, and are constantly in use to raise the weight of the body in walking, leaping, etc. These are all the muscles I intend to trouble you about, and before our next lecture I hope that you will have learned from these diagrams to place the muscles with their proper actions and names in your own bodies. Let me go through them once more, and as I name them and point them out, let each one of you use the very muscle I name, and try and place it clearly in this way. Let me with this diagram of the horse show you the corresponding bones and muscles in the horse. This comparison will, I hope, help you to remember and become familiar with them. Note the position of the scapula in the horse. Here we find a difference from man. We all look for a long sloping shoulder, and we find

that the shoulder-blade in the horse is prolonged by a cartilaginous border into the withers of the horse. In man this border is cartilage up to the age of seventeen years only. Then the border becomes ossified. Note the quick disappearance of the ulna in the horse except up here. In the old, heavy, early types of quadrupeds, of which the elephant is a surviving link, the weight of the body is borne on the ulna, and only in a lesser degree on the radius. This must mean considerable jarring to the frame of the animal. Note before we pass away from the shoulder that the clavicle is absent in the horse. In animals which have claws, and which therefore use their arms laterally as well as straight in front of them, this bone exists in a greater or less degree of development, and in all birds which use their wings constantly and powerfully the two clavicles are fused together in the middle. The so-called "wish-bone" of a chicken consists of the two clavicles.

The knee here immediately below the radius might at first sight puzzle you. Look at it, and see that it is formed of two rows of small bones just like our wrist or carpal bones. Below these bones is what is called the cannon bone in the horse, one of the metacarpal bones in our hand. The horse, in fact, stands on one finger, and here, below the cannon bone, we have the representatives of our first, second, and third phalanges. Beside the cannon bone we have these thin little bones on each side, called the splint bones, which represent the undeveloped metacarpal bones. The horse, you may take it, stands upon his middle finger, developed specially to suit his requirements.

Coming to the hind-quarter of the horse, note the resemblance in general type of the pelvis, the femur, the patella, and also the development of the os calcis

(our heel-bone) or hock-bone of the horse. Note the enormous leverage which this gives, a leverage which we try to obtain by rising off the heel when we want to "sprint."

[In the opinion of the Author, no useful purpose would be served by enlarging the size of this book so as to contain the remaining lectures to his Ambulance Section. These lectures, indeed, are original only in form, but were taken by him from the official book of the St. John Ambulance Association, written by James Cantlie, M.B., published by the association, and to be obtained from all booksellers at 1s. net. With the above introductory lectures to prepare the way for the study of the work of an Ambulance Section, the Author thinks and hopes that anyone will find much to interest him in reading carefully through "First Aid to the Injured."]

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